BP 101 T

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

Course Outcomes:

C101.1	To recognize the various homeostatic mechanisms, basic anatomical terms and cellular level organization.
C101.2	To summarize the characteristics of different types of tissues and their location in various organs
C101.3	To organize the structure and functions of skin, bones and joints of human body.
C101.4	To analyze the importance of blood, lymphatic system and immunity in human body.
C101.5	To relate the physiology of sympathetic, parasympathetic, spinal/cranial nerves and organization of special senses.
C101.6	To adapt the anatomy and physiology of heart and blood vessels.

Course Content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I • **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.	**10**	1. Anatomy and Physiology – Gerard J.Tortora, 2014, India edition: wiley publications, unit:1 & 3, Chapter: 1, 5

• **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.		2. Ross & Wilson anatomy & Physiology in health & illness – Anne waugh & Allison Grant; 10th edition, Churchill livingstone publications.
UNIT-II • **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.	**10**	1. Principles of anatomy and physiology – Gerard J.Tortora; 2014 Indian edition; wiley publications; Unit:5-9. 2. Ross & Wilson anatomy and physiology in health & illness – Anne Waugh & Allison Grant, 10th Grant edition, churchill living stone publications. Chapter, 16.
UNIT-III • **Body fluids and blood** • Body fluids, composition and functions of blood, hemopoeisis, 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.	**10**	Principles of anatomy & physiology – Gerard J.Tortora. 2014 Indian edition wiley publications, Unit.12-16.

UNIT-IV **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.	**08**	1. Principles of anatomy & physiology – Gerard J.Tortora 2014, Indian edition wiley publications, Unit.12-16. 2. Ross & Wilson anatomy & physiology in health & illness – Anne Waugh & Allison Grant, 10th edition, Churchill living stone publications.
UNIT-V • **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.	**07**	Principles of anatomy & physiology – Gerard J.Tortora 2014; Indian edition wiley publications, Unit. 19-22.

BP 102 T

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 Outcomes:

C102.1	To understand the principles of volumetric/gravimetric and gasometric analytical techniques.
C102.2	To gain knowledge of sources of errors and minimizing techniques.
C102.3	To analyze the techniques of volumetric, gravimetric and gas analysis.
C102.4	To explain about accuracy, precision and significant figure error concepts.
C102.5	To compute analytical results and understand the physiochemical concepts of analysis, theories of acids and bases, stoichiometry etc.,
C102.6	To analyze various electro chemical titrations.

Course Content:

Chapter / Topic	Duration (Hrs.)	References
UNIT-I **(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.	**10**	1.Pharmaceutical analysis, P.C.Kamboj, Vol.1, 2nd edition, vallabh publications, 2007, chapter 4(b) 2. Indian Pharmacopoeia and practical pharmaceutical chemistry, A.H.Beckett, J.B. Stenlake, 4th edition, Vol-1, CBS Publishers, 2007, chapter-4. 3.A.I. Vogel's : Text book of quantitative chemical analysis, 6th edition, pearson education, 2008, chapter 10.

(c) Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.		4. Pharmaceutical drug analysis Ashutoshkar, New Age International (P) Limited, publications, Ashutoshkar. 5. Instrumental methods of analysis (chemical) Gurudeep R Chatwal, ShamK.Anand chapter, 1.
UNIT-II • **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.	**10**	1.Pharmaceutical analysis, Dr.A.V.Kasture, 14th edition, Vol.1, Niraliprakasan, 2010, Chapter-6, 7. 2.Pharmaceutical analysis, P.C.Kamboj, Vol-1, 2nd edition, vallabh publications, 2007, chapter, 3 and 8.
UNIT-III • **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 diazotisation titration.	**10**	1.Quantitative analysis by R.A. Day and A.L.Underwood. 6th edition, Prentice hall of India, 2006, chapter 06, 07 and 08, 09. 04. Gravimetry. 2.Pharmaceutical Analysis, P.C.Kamboj, Vol.1, 2nd edition, vallabh publications, 2007, chapter 6, 9, 11, 06.gravimetry. 3.AH.Becket & J.B.Stenlake's practical pharmaceutical chemistry, Vol.1 & 11, stahlone press of university of London, 4th edition, CBS Publishers', 2007, Chapter.8.
UNIT-IV **Redox titrations** (a) Concepts of oxidation and reduction	**08**	1.Pharmaceutical analysis, P.C.Komboj, Vol.1, 2nd edition, vallabh publications, 2007, chapter.10.

(b) Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate		2.Quantitative analysis by R.A.Day and A.L.Underwood. 6th edition, Prelantice hallot India, 2006, chapter 10.
UNIT-V • **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	**07**	1.Phamaceutical analysis, A.V.Kasture, Vol.1, 14th edition, Niraliprakashan, 2010, Chapter 18 and 19. 2.Instrumetal methods of chemical analysis. Gurudeep R.Chatwal Sham K. Anand. Himalaya publishing house chapter, 22. Page No. 2.482, Chapter, 25, page 2.515-2.522 Chapter. 22, page No. 2.482-2.497 3.Instrumental methods of chemical analysis, Gurudeep R Chatwal. Sham K Anand. Himalaya publishing house, chapter 26, page 2.523-2.533.

BP 103 T

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 and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Preparation of various conventional dosage forms

Course Outcomes:

C103.1	To know the historical background and profession of pharmacy and basics of pharmaceutical dosage forms.
C103.2	To understand the importance of prescription and posology.
C103.3	To solve pharmaceutical calculations and understand the formulation of powders and liquid dosage forms.
C103.4	To develop monophasic and biphasic liquid dosage forms.
C103.5	To explain the concepts of suppositories and pharmaceutical incompatibilities.
C103.6	To formulate and evaluate semi solid dosage forms.

Course Content:

Chapter / Topic	Duration (Hrs.)	References
UNIT – I • **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.	**10**	1. Remington "The science and practice of pharmacy", Vol-1, 20th edition, 2000. 2. R.M.Mehta. "Pharmaceutics-I", 5th edition, 2010. 3. Loyd V.Allon, Howard C.Ansel. "Pharmaceutical dosage forms and drug delivery systems", 9th edition, 2010. 4. Cooper and Gunn's "Dispensing for Pharmaceutical studies" edited by S.J.Carter, 12th edition.

UNIT – II • **Pharmaceutical calculations**: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight. • **Powders:** Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions. • **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.	**10**	1. Remington "The science and practice of pharmacy", Vol-1, 20th edition, 2000 2.Cooper and Gunn's "Dispensing for Pharmaceutical studies" edited by S.J.Carter, 12th edition. 3.R.M.Mehta, "Pharmaceutics-II", 1st edition, 1997 4.R.M.Mehta, "Dispensing Pharmacy", 4th edition, 2012.
UNIT – III • **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 suspensions & 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.	**10**	1.Cooper and Gunn's. "Dispensing for Pharmaceutical studies", 12th edition by S.J.Carter. 2.Loyd V.Allen, Howard C.Ansel "Pharmaceutical dosage forms and drug delivery systems", 9th edition, 2010. 3.R.M.Mehta, "Pharmaceutics-II", 1st edition, 1997.

UNIT – IV • **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparation. Displacement value & its calculations, evaluation of suppositories. • **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.	**08**	1.Loyd V.Allen, Howard C.Ansel, "Pharmaceutical dosage forms and drugt delivery systems", 9th edition, 2010. 2. Cooper and gunn's "Dispensing for pharmaceutical students", 12th edition by S.J.Carter. 3.R.M.Mehta, "Pharmaceutics-II" 1st edition, 1997.
UNIV – V • **Semisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosage forms.	**07**	1.Loyd.V.Allen, Howard C.Ansel, "Pharmaceutical dosage forms and drug delivery systems", 9th edition, 2010. 2. Cooper and Gunn's "Dispensing for pharmaceutical students" 12th edition by S.J.Carter.

BP 104 T

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 Outcomes:

C104.1	To understand the history and concept of pharmacopoeia and its editions.
C104.2	To know the sources of impurities and methods to determine the impurities in inorganic pharmaceuticals.
C104.3	To gain knowledge on limit tests of different pharmaceutical inorganic compounds.
C104.4	To understand the method to prepare inorganic pharmaceuticals.
C104.5	To justify the medicinal importance of acidifiers, antacids, cathartics and antimicrobial agents as gastrointestinal agents.
C104.6	To discuss the handling and applications of radiopharmaceuticals.

Course Content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT I • **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	**10**	1.Pahrmaceutical inorganic chemistry by G.R.Chatwal, Chapter-4, Pg.No.31 2.Pharmaceutical Inorganic Chemistry by Alagarsamy, chapter-5, Pg.No.101. 3.A text book of Inorganic medicinal chemistry by surendra N. Pandeya. 4.Text book of Pharmaceutical Chemistry-1 (Inorganic) by Mohammed Ali, chapter-15 and 16, pg.no. 237.

UNIT II • **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurement 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.	**10**	1.Inorganic Pharmaceutical Chemistry by Dr.H.P.Tipnis, Dr.P.S.Dhake. 2.Pharmaceutical Inorganic chemistry by G.R.Chatwal. chapter-13 & 16, Pg.No.266 & 103 3.Pharmaceutical Inorganic chemistry by Alagarsamy. Chapter-3 & 6, pg.no.61, 331 & 351. 4.Bently and Driver's text book of pharmaceutical chemistry, chapater-17, pg.no.202. 4.Text book of pharmaceutical chemistry-I by Mohammed Ali, chapter-6, Pg.No.134.
UNIT III • **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.	**10**	1.Pharmaceutical Inorganic chemistry by G.R.Chatwal, chapter-8, Pg.No.152. 2. Pharmaceutical Inorganic Chemistry by Alagarsamy, chapter-6, pg.no.168, 189 and 233.
UNIT IV • **Miscellaneous compounds** **Expectorants:** Potassium iodide, Ammonium chloride*. **Emetics**: Copper sulphate*, Sodium potassium tartarate **Haematinics:** Ferrous sulphate*, Ferrous gluconate	**08**	1.Pharmaceutical Inorganic chemistry by G.R.Chatwal, chapter-12 & 16, pg.no.255 & 365. 2.Pharmaceutical Inorganic Chemistry by Alagarsamy, chapter-6, Pg.No.405, 467 and 469.

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite 333 **Astringents**: Zinc Sulphate, Potash Alum		
UNIT V • **Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of □, β, □ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.	**07**	1.Bently and driver's rent book of Pharmaceutical chemistry, chapter-10, Pg.No.121. 2.Pharmaceutical Inorganic chemistry, chapter-17, pg.no.340.

BP 105 T

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

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

Course Outcomes:

C105.1	To understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation.
C105.2	To communicate effectively (Verbal and Non Verbal).
C105.3	To effectively manage the team as a team player.
C105.4	To understand Do's and Don'ts of an interview.
C105.5	To analyze and apply communication skills and other interpersonal skills.
C105.6	To develop Leadership qualities and essentials.

Course content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT – I • **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.	**07**	1. Communicaiton Skills by Dr.Nageswar Rao, Dr.Rajendra P.Das, 2005, Chapter-1, pg.no.1-29

• **Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.		2. Communication skills by Dr.Nageshwar Rao, Dr.Rajeswar P Das, 2005, Chapter-2, Pg.No.30-41.
UNIT – II • **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.	**07**	1.Communication skills by Dr.Nageshwar Rao, Dr.Rajendra P Das, 2005, Chapter-6, Pg.No.102-125. Communication skills by Varada S Bhaskara Rao, 2006, Pg No. 231.
UNIT – III • **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.	**07**	1. Communication skills by Dr.Nageshwar Rao, Dr.Rajendra P Das, 2005, Chapter-3, Pg.No.42-67 2. Communication skills by Dr.Nageshwar Rao, Dr.Rajendra P Das, 2005, Chapter-11, Pg.No.240
UNIT – IV • **Interview Skills:** Purpose of an interview, Do's and Dont's of an interview	**05**	1. Interview Skills and Group discussion by Anthony, 2016, Chapter-12, 13, 15, Page No.19-30, Pg.No.33-35.

• **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery.		2. A must for every student/person by Anthony, 2016, Chapter-21, Page No.46
UNIT – V **Group Discussion:** Introduction, Communication skills in group discussion, Do's and Dont's of group discussion.	**04**	1. Interview skills and group discussion by Anthony, 2016, Chapter-10, Page No.76-85

BP 106 RBT

BP106RBT-REMEDIAL BIOLOGY
THEORY (30 HOURS)

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 Outcomes :

C106.1	To understand the characters of living organisms and classification of kingdoms
C106.2	To develop basic knowledge on morphology and functions of various plant parts such as root, stem, leaf, flower, fruit and seed.
C106.3	To analyze functions of organs in the cardiovascular, digestive and respiratory systems of human body
C106.4	To assess the physiology of brain and spinal cord, and role of kidney in regulation of body fluids
C106.5	To determine role of hormones in regulation of various organs functioning in the body and process of oogenesis and spermatogenesis.
C106.6	To elaborate the physiology, nutrient requirements for plants and to predict plant/animal tissues.

Course content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT I **Living world:** • Definition and characters of living organisms • Diversity in the living world • Binomial nomenclature • Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus, **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 & Dicotylidones.	**07**	1. Intermediate first year botany, Dr.T.Kailasanath Sarma; telugu akademi publications, chapter-5-7, 9, 10, 12-15.

UNIT II **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	**07**	1.Principles of anatomy and physiology Gerard J.Tortora, 2014, Indian edition, wiley publications, unit-24. Principles of anatomy and physiology-Gerard J.Tortora, 2014, Indian edition wiley publications, unit-23.
UNIT III **Excretory products and their elimination** • Modes of excretion • Human excretory system-structure and function • Urine formation • Rennin 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	**07**	1.Principles of anatomy and physiology-Gerard J.Tortora, 2014, Indian edition, wiley publications, unit-26. 2.Ross & Wilson anatomy and physiology in health and illness-anne Waugh & Allison grant, 10th edition, Churchill livingstone publications, chapter-18.

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 **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.	**05**	1.Botany-A.C.Dutta, 6th edition, oxford university press publications, part-III, chapter No.11 2.Intermediate 1st year botany, Dr.T.Kailasnath Sarma; Telugu akademi publication , chapter, 18, 20, 21
UNIT V **Plant respiration:** Respiration, glycolysis, fermentation (anaerobic). **Plant growth and development** • Phases and 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** a. Text book of Biology by S. B. Gokhale b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.	**04**	1.Botany-A.C.Dutta, 6th edition, Oxford university press publications, part-III, chapter-11. 2. Intermediate first year botany-Dr.T.Kailasnath Sarma, telugu akademi publications, chapter NO. 18, 20, 12. 3.Pharmaceutical biology-S.B.Gokhale, 5th edition, Nirali prakashan publications, Unit No. 8.

BP 106 RMT

BP106RMT-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 Outcomes :

C106.1	To understand the role of mathematics in pharmacy.
C106.2	To know about theory and their application in pharmacy.
C106.3	To relate the mathematical tools in the wide professional views and solve problems of trigonometry, calculus and matrices.
C106.4	To solve the different types of problems by applying theory.
C106.5	To adopt both conventional and creative techniques to the solutions of mathematical problems.
C106.6	Apply a range of techniques effectively to solve problems including theory deduction, approximation and simulation.

Course Content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT – I • **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,	**06**	1.Intermediate mathematics by Venkateswara Rao, N.Krishna Murthy, B.V.S.Sharma, 25th revised edition, 2003, vol.1, S.Chand & Co, algebra. 2, 4 2.Higher Engineering mathematics by Dr.B.S.Grawal, 40th edition, Kanna publishers, Unit 1. 3. Remedial mathematics-Dr.Riyaz Ahmad Khan, S.Chand & Co, 2009, Unit-1.

• **Limits and continuity** : Introduction, Limit of a function, Definition of limit of a function ($\in$ - δ Definition) $\lim_{x\to a} \frac{x^n - a^n}{x - a} = na^{n-1}$, $\lim_{\theta\to 0} \frac{\sin}{\theta}$		
UNIT –II • **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, Applicationof Matrices in solving Pharmacokinetic equations.	**06**	1.Intermediate mathematics by V.Venkateswara Rao, Krishna Murthy, B.V.S.Sharma, Vol.2, Unit-3, 6. 2.Higher engineering mathematics by B.S.Grawal, 40th edition, Kanna publishers, Unit-1.
UNIT – III • **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.	**06**	1.Diffenential calculus by Shanti Narayan, Dr.P.K.Mithal, S.Chand publishers, 15th edition: 2010: Chapter. 3, 4, 5, 9. 2. Remedial mathematics.Dr.Riyaz Ahmad Khan, S.Chand & Co: 2009, Unit 4, 5. 3. Higher Engineering mathematics by Dr.B.S.Grawal, 40th edition, Kanna Publishers, Unit-2

UNIT – IV • **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.	**06**	1.Intermediate mathematics by V.Venkateswara Rao, Krishna Murthy, B.V.S.Sharma, 25th revised edition. 2003, vol.1, 2D geometry. 2. Remedial Mathematics, Dr.Riyaz Ahmad Khan. S.Chand & Co. 2009, Unit-3. 3.Integral calculus by shanthi Narayan and Dr.P.K.Mittal : S.Chand publishers, 15th edition, 2010, chapter-1, 2.
UNIT-V • **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**	**06**	1.Higher Engineering Mathematics by Dr.B.S.Grawal, 40th edition, kanna publishers, Unit-4. 2. Intermediate mathematics by V.Venkateswara Rao, Krishna Murthy, B.V.S.Sharma, Vol.2, 3. Remedial Mathematics, Dr.Riyaz Ahmed Khan, S.Chand & Co, 2009, Unit-7

BP 107 P

BP107P-HUMAN ANATOMY AND PHYSIOLOGY - I
PRACTICAL (60 HOURS)

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**.**

Course Outcomes:

C107.1	To recall handling of compound microscope and to memorize various animal tissues.
C107.2	To summarize the characteristics of different bones (skeletal system).
C107.3	To identify the bleeding/clotting time and blood group.
C107.4	To analyze the blood cells using heamocytometry.
C107.5	To estimate the hemoglobin concentration of human blood and blood pressure.
C107.6	To predict the erythrocyte sedimentation rate of human blood and heart rate/ pulse rate.

Course Content:

S. No.	Name of the Experiment	Durat-ion (hrs)	References
01	Study of compound microscope.	**3**	Practical anatomy & physiology- Dr.R.K.Goyal, 11th edition, B.S.Shah, Prakashan publications, section-I, exp.no.1
02	Microscopic study of epithelial and connective tissue	**4**	Ross & Wilson Anatomy and physiology in health and illness – Anne Waugh & Allison grant; Churchill living stone publications: 10th edition, section-I, exp.no.3.
03	Microscopic study of muscular and nervous tissue	**4**	Practical anatomy & physiology- Dr.R.K.Goyal, 11th edition, B.S.Shah, prakashan publications, section-I, Exp.no.3.
04	Identification of axial bones	**4**	Practical anatomy and physiology- Dr.R.K.Goyal, 11th edition, B.S.Shah, Prakashan publications, section-I, exp.no.4
05	Identification of appendicular bones	**4**	Practical anatomy and physiology, Dr.R.K.Goyal, 11th edition, B.S.Shah, prakashan publications, section-I, exp.no.4.

06	Introduction to hemocytometry.	**4**	A text book of practical physiology-C L Ghai, 6th edition, Jaypee publications, section-I, exp.no.3
07	Enumeration of white blood cell (WBC) count	**5**	A text book of practical physiology-C L Ghai, 6th edition, Jaypee publications, section-I exp.no.11.
08	Enumeration of total red blood corpuscles (RBC) count	**6**	A text book of practical physiology-C L Ghai, 6th edition, Jaypee publications, Section-I, exp.no.8
09	Determination of bleeding time	**3**	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications; section-I, exp.no.19.
10	Determination of clotting time	**4**	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, section-I, exp.no.19.
11	Estimation of hemoglobin content	**4**	A text book of practical physiology-C L Ghai, 6th edition, jaypee publications, section-I, exp.no.7.
12	Determination of blood group.	**4**	Practical anatomy & physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, section-I, exp. No. 18.
13	Determination of erythrocyte sedimentation rate (ESR).	**4**	A text book of practical physiology-C L Ghai, 6th edition, Jaypee publications, section-I, exp.no.17
14	Determination of heart rate and pulse rate.	**4**	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, Section-I, Exp.no.9
15	Recording of blood pressure.	**3**	Practical anatomy & physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah, prakashan publications, section-I, Exp.no.9

BP 108 P

BP108P-PHARMACEUTICAL ANALYSIS-I
PRACTICAL (60 HOURS)

Course Outcomes :

C108.1	To understand the importance of calibration, calibration of weights, pipette and burette.
C108.2	To demonstrate standardization of solutions with different strengths.
C108.3	To experiment with volumetric analysis such as acidimetry and alkalimetry, oxidation and reduction reactions, iodometry, complexometry, precipitation and non-aqueous titration.
C108.4	To analyze gravimetric analytical techniques.
C108.5	To evaluate pharmaceuticals by cerimetry.
C108.6	To analyze pharmaceuticals by electro-analytical methods.

Course Content:

S. No.	Name of the Experiment	Durat-ion (hrs)	References
01	**Limit Test of the following** (1) Chloride (2) Sulphate (3) Iron (4) Arsenic	10	1.Practical pharmaceutical chemistry, 4th edition-part one, A.H.Beckelt, J.B.Stenlake, CBS publishers and distributors, page.no.30-43 2.Indian pharmacopoeia, 2007, vol.1, pg.no.2.3.10 (76, 77), 2.3.08.
02	**Preparation and standardization of** (1) Sodium hydroxide (2) Sulphuric acid (3) Sodium thiosulfate (4) Potassium permanganate (5) Ceric ammonium sulphate	14	1.AH.Becket & J.B.Stenlake's practical pharmaceutical chemistry, Vol.1 & 11, stahlone press of university of London, 4th edition, CBS Publishers', 2007, page no 141. 2.Bently and Driver's Text book of Pharmaceutical Chemistry, Page no 203. 2. AH.Becket pageno 140. 3. AH.Becket pageno 187.Bently and Driver's pageno 76. 4. AH.Becket pageno 177. 5. A.I. Vogel's : Text book of quantitative chemical analysis, 6th edition, pearson education, 2008, page no 454.Bently page no 77.
03	**Assay of the following compounds along with Standardization of Titrant** (1) Ammonium chloride by acid base titration	24	1. AH.Becket & J.B.Stenlake's practical pharmaceutical chemistry, Vol.1 & 11, stahlone press of university of London, 4th edition, CBS Publishers', 2007, page no 147.

	(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		2. AH.Becket, page no195. Bently and Driver's Page no 266. 3. AH.Becket, page no185. 4. AH.Becket, page no 220. Bently page no 236. 5. AH.Becket, page no 178. Bently page no 172. 6. AH.Becket, page no 152. 7. AH.Becket, page no 201.
04	**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	12	1.AH.Becket & J.B.Stenlake's practical pharmaceutical chemistry, Vol.1 & 11, stahlone press of university of London, 4th edition, CBS Publishers', 2007, part 2, page no 182. 2.Pharmaceutical analysis ,Volume - 1, Dr A.V. Kasture, Niraliprakasan , page no 19.1-19.10(Conductometry) Page no 18.1-18.17(Potentiometry)

BP109P

BP109P-PHARMACEUTICS-I
PRACTICAL (60 HOURS)

Course Outcomes:

C109.1	To recall the principles used in the preparation of solid, liquid and semi solid dosage forms.
C109.2	To experiment with monophasic liquid dosage forms for internal and external administration.
C109.3	To prepare biphasic liquid dosage forms.
C109.4	To design powders and granules.
C109.5	To develop semi solid dosage forms.
C109.6	To formulate suppositories.

Course Content:

S. No.	Chapter / Topic	Dura-tion (Hrs.)	References
01	**Syrups :** a) Syrup IP'66 b) Compound syrup of Ferrous Phosphate BPC'68	04	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach"
02	**Elixirs** a) Piperazine citrate elixir b) Paracetamol pediatric elixir	04	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach"
03	**Linctus** a) Terpin Hydrate Linctus IP'66 b) Iodine Throat Paint (Mandles Paint)	04	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach"
04	**Solutions** a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugol's solution	10	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach"
05	**Suspensions** a) Calamine lotion b) Magnesium Hydroxide mixture	08	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002

	c) Aluminimum Hydroxide gel		2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach". 3.A.K.Seth, "Systematic approach of practical pharmaceutics", 1st edition, 2007.
06	**Emulsions** a) Turpentine Liniment b) Liquid paraffin emulsion	06	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach"
07	**Powders and Granules** a) ORS powder (WHO) b) Effervescent granules c)Dusting powder d)Divded powders	08	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach" 3.A.K.Seth, "Systematic approach of practical pharmaceutics", 1st edition, 2007.
08	**Suppositories** a) Glycero gelatin suppository b) Coca butter suppository c) Zinc Oxide suppository	06	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach" 3.A.K.Seth, "Systematic approach of practical pharmaceutics", 1st edition, 2007.
09	**Semisolids** a) Sulphur ointment b) Non staining-iodine ointment with methyl salicylate c) Carbopal gel	06	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach"
10	**Gargles and Mouthwashes** a) Iodine gargle b) Chlorhexidine mouthwash	04	1.R.S.Gaud, G.D.Gupta, "Practical Pharmaceutics", 1st Edition, 2002 2. N.K.Jain, Vijay Mishra, "Pharmaceutics-I, A practical approach"

BP 110 P

BP110P-PHARMACEUTICAL INORGANIC CHEMISTRY PRACTICAL (60 HOURS)

Course Outcomes :

C110.1	To recall the sources of limit tests, preparation and identification of compounds.
C110.2	To demonstrate the preparation of inorganic pharmaceuticals.
C110.3	To apply knowledge to perform modified limit tests.
C110.4	To analyze various inorganic pharmaceutical compounds.
C110.5	To select suitable method for the preparation of inorganic pharmaceuticals.
C110.6	To assess quality of inorganic pharmaceuticals.

Course Content:

S. No.	Chapter / Topic	Dura-tion (Hrs.)	References
01	**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 Heavymetals Limit test for Lead Limit test for Arsenic	24	1.Practical pharmaceutical chemistry, 4th edition-part one, A.H.Beckett, J.B.Stenlake, CBS Publilshers and distributors, chapter-1, pgno.30-43 2. Indian pharmacopaeia 2007, vol.1, pg.no.76, 77 and 78.
02	**Identification test** Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate	15	1.Pharmaceutical chemistry inorganic, G.R.Chatwal, Himalaya publishing, house, chapter, 28, pg.no.438-456.
03	**Test for purity** Swelling power of Bentonite Neutralizing capacity of aluminum hydroxide gel Determination of potassium iodate and iodine in potassium Iodide	09	1.Swelling power of bentowile, Indian pharmacopoeia, 2018, vol. 2, pg.no.1338 2.Indian pharmacopoeia, 2018, vol.2, pg.no.1186. 3.Indian pharmacopoeia, 2018, vol.3, pg.no.2968.
04	**Preparation of inorganic pharmaceuticals** Boric acid Potash alum Ferrous sulphate	12	1.Bently and driver's text book of pharmaceutical chemistry, pg.no.195, 274. 2.Pharmaceutical chemistry inorganic G.R.Chatwal. Himalaya publishing house, chapter, 14, pg.no.309.

BP 111 P

BP111P-COMMUNICATION SKILLS
PRACTICAL (30 HOURS)

Course Outcomes :

C111.1	To understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation.
C111.2	To apply the practical skills for effective communication (Verbal and Non verbal).
C111.3	To distinguish pronunciation of vowel and consonant sounds.
C111.4	To take part in advanced learning on comprehension/direct and indirect speech.
C111.5	To develop the interview handling skills.
C111.6	To improve in email etiquette.

Course Content:

The following learning modules are to be conducted using wordsworth® English language lab software

S. No.	Chapter / Topic	Dura-tion (Hrs.)	References
01	**Basic communication covering the following topics** Meeting People Asking Questions Making Friends What did you do? Do's and Dont's	6	Spoken English by Anthony, 2013, Chapter-3, page No. 163-295
02	**Pronunciations covering the following topics** Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds)	6	Spoken English by Anthony, 2013, Chapter-3, page No. 13-28
03	**Advanced Learning**		
	Listening Comprehension / Direct and Indirect Speech Figures of Speech Effective Communication Writing Skills Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills	18	1. Communication skills by Dr.Nageshwar Rao, Dr.Rajendra P Das, 2005, Chapter-3, Pg.No.42-67 2. Communication and soft skills by Anthony, 2016, Page No.146-152 3. Communication and soft skills by Anthony, 2016, Page Nos.164 to 167, 22, 37

			4. Anthony, 2016, Page Nos.19 to 38 5.Communication skills by Dr.Nageshwar Rao, Dr.Rajendra P Das, 2005, Chapter-11, Pg.No.209 to 240 6.Communication skills by Dr.Nageshwar Rao, Dr.Rajendra P Das, 2005, Pg.No.84 ro 101

BP 112 RBP

BP112RBP-REMEDIAL BIOLOGY
PRACTICAL (30 HOURS)

Course Outcomes :

C112.1	To know the handling of microscope and permanent slide preparation techniques.
C112.2	To understand the structure of cell and its inclusions.
C112.3	To identify various plant parts, and to organize their modifications
C112.4	To categorize the physiology of frog by using computer models
C112.5	To assessthe microscopical study and identification of tissues pertinent to stem, root, leaf, seed, fruit and flower.
C112.6	To compile the bones identification, blood group, blood pressure and tidal volume determination.

Course Content:

S. No.	Chapter / Topic	Dura-tion (Hrs.)	References
01	Introduction to experiments in biology a) Study of Microscope b) Section cutting techniques c) Mounting and staining d) Permanent slide preparation	6	Practical Botany-D.Subrahmanyam, 1st edition, universal publishing house, part-A
02	Study of cell and its inclusions	3	Pharmaceutical biology-S.B.gokhale, 5th edition, Nirali Prakasan publications, unit-4 & 6
03	Study of Stem, Root, Leaf, seed, fruit, flower and their modifications	3	Practical Botany-D.Subrahmanyam, 1st edition, universal publishing house, part-A, exp.No.2, 3, 4
04	Detailed study of frog by using computer models	3	Physio ex. Software, prodissection
05	Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower	3	Practical botany-D.Subrahmanyam, 1st edition, Universal publishing house, part-B
06	Identification of bones	3	Practical anatomy and physiology, Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, section-I. exp.no.4

07	Determination of blood group	3	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition. B.S.Shah prakashan publications, section-I, exp.no.18
08	Determination of blood pressure	3	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, Section-I, exp.no.9
09	Determination of tidal volume	3	Practical anatomy & physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, section-I, exp.no.10.

BP 201 T

BP201T-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:

01. Explain the gross morphology, structure and functions of various organs of the human body.
02. Describe the various homeostatic mechanisms and their imbalances.
03. Identify the various tissues and organs of different systems of human body.
04. 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.
05. Appreciate coordinated working pattern of different organs of each system
06. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Outcomes:

C201.1	To relate the basic knowledge about central nervous system including nervous tissue, brain and spinal cord.
C201.2	To illustrate the structure and functions of gastrointestinal tract and to learn about ATP/CTP/BMR.
C201.3	To learn about structure and functions of respiratory system and various mechanisms involved in regulation of respiration.
C201.4	To categorize the anatomy of urinary system and physiology of urine formation/micturition.
C201.5	To appraise the essentiality of endocrine glands and their hormones.
C201.6	To predict the physiology of male and female reproductive organs and concepts of genetics.

Course Content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I • **Nervous system** Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential,	**10**	1. Principles of anatomy & physiology-Gerad J.Tortora, 2014 Indian edition wiley publications , unit 12-16.

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)		2. Ross & Wilson anatomy and physiology in health and illness-anne Waugh & Allison grant, 10th edition, Churchill living stone publications, chapter-7.
UNIT-II • **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.	**06**	Principles of anatomy and physiology Gerard J.Tortora; 2014 Indian edition; wiley publications, unit-24.
UNIT-III • **Respiratory system 10 hours** 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.	**10**	1. Principles of anatomy & Physiology-Gerard J.Tortora, 2014 Indian edition wiley publications, unit-23. 2. Ross & Wilson anatomy and physiology in health and illness-Anne Waugh & Allison Grant; 10th edition, Churchill living stone publications, chapter-10.

UNIT-IV • **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.	**10**	Principles of anatomy and physiology Gerard J.Tortora, 2014 Indian edition; willey publications, unit-26.
UNIT-V • **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	**09**	Ross & Wilson anatomy and physiology in health and illness – Anne Waugh & Allison, Grant; 10th edition; Churchill living stone publications, chapter-18.

BP 202 T

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 Outcomes :

C202.1	To explain the nomenclature and uses of organic compounds.
C202.2	To elaborate the concepts of hybridization, electronic and steric effects of organic compounds.
C202.3	To remember the orientation of reactions, mechanism and stereochemistry.
C202.4	To apply the knowledge for the identification of organic compounds.
C202.5	To discuss chemistry, properties and reactions of various organic compounds.
C202.6	To appraise the named reactions & applications of pharmaceutical 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.

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I • **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.	**07**	1. Organic Chemistry, Robert ThOrnton Morrison, Robert Neilson Boyd, 6th edition, Doring Kindersley (India) Pvt. Ltd., 2009, Chapter-1. 2. Pharmaceutical Organic Chemistry, Dr.Rama Rao Nadendla, Victory publishers, Chapters-3,6.

UNIT-II • **Alkanes*, Alkenes* and Conjugated dienes*** SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP^2 hybridization in alkenes E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 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.	**10**	1. Organic Chemistry, Robert ThOrnton Morrison, Robert Neilson Boyd, 6th edition, Doring Kindersley (India) Pvt. Ltd., 2009, Chapters-3,8,9,11. 2.Advanced organic chemistry Reaction and Mechanisms,Maya Shankar Singh,Pearson education (singapore) Pte.Ltd-2005,Chapters-4,5,6. 3. Pharmaceutical Organic Chemistry, Dr.Rama Rao Nadendla, Victory publishers, Chapters-7,9,10,11.
UNIT-III • **Alkyl halides*** SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 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	**10**	1.Advanced organic chemistry Reaction and Mechanisms,Maya Shankar Singh,Pearson education (singapore) Pte.Ltd-2005,Chapter-3. 2. Pharmaceutical Organic Chemistry, Dr.Rama Rao Nadendla, Victory publishers, Chapters-12,13. 3. Organic Chemistry, Robert ThOrnton Morrison, Robert Neilson Boyd, 6th edition, Doring Kindersley (India) Pvt. Ltd., 2009, Chapters-5,6.
UNIT-IV • **Carbonyl compounds* (Aldehydes and ketones)** Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro	**10**	1. Pharmaceutical Organic Chemistry, Dr.Rama Rao Nadendla, Victory publishers, Chapters-16,17.

reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.		2. Organic Chemistry, Robert ThOrnton Morrison, Robert Neilson Boyd, 6th edition, Doring Kindersley (India) Pvt. Ltd., 2009, Chapters-18,21.
UNIT-V • **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	**08**	1. Organic Chemistry, Robert ThOrnton Morrison, Robert Neilson Boyd, 6th edition, Doring Kindersley (India) Pvt. Ltd., 2009, Chapters-19,20,22,23. 2. Pharmaceutical Organic Chemistry, Dr.Rama Rao Nadendla, Victory publishers, Chapters-18,19,21.

BP 203 T

BP203T-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 shell 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 Outcomes:

C203.1	To remember the properties, significance and metabolic reactions of carbohydrates, lipids, nucleic acids, proteins and amino acids
C203.2	To understand the metabolism of carbohydrates and process of electron transport and ATP formation
C203.3	To apply the concept of catalytic activity and enzyme inhibition in design of new drugs, diagnostic and therapeutic applications of enzyme
C203.4	To distinguish the process of DNA replication, transcription and translation
C203.5	To appraise the causes, manifestations and diagnosis of metabolic disorders
C203.6	To discuss the metabolism of nucleic acids, lipids and amino acids

Course Content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT I • **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.	**08**	1. Biochemistry, U.Satya narayana and U.Chakrapani, 4th edition, Elsevier & Books and allied Pvt Ltd., 2013, Chapter.1, 2, 3, 4 and 5. 2. A text book of Biochemistry, AVSS Rama Rao, 9th edition, UBS publishers and distributers, 2004, Chapter.15 3. Text book of

Energy rich compounds; classification; biological significances of ATP and cyclic AMP.		biochemistry for medical students, D M Vasudevan, Sree Kumari S, Kannan vardhyanadhan, 6th edition, Jaypee brothers medical publishers pvt. Ltd., 2011, chapter.3, 4, 6, 7 and 16.
UNIT II • **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 Phosphorylation. Inhibitors ETC and oxidative phosphorylation/Uncouplers level.	**10**	1. Biochemistry, U.Satyanarayana and U.Chakrapani, 4th edition, Elsevier & books and allied pvt. Ltd., 2013, Chapter.2. 2. A text book of Biochemistry, AVSS Rama Rao, 9th edition, VBS Publishers & distributers, 2004, chapter.3, 15 and 16. 3. Text book of Biochemistry for medical students, D.M.Vasudevan, Sree Kumari S, Kannan Vaidhyanathan, 6th edition, Jaypee brothers medical publishers Pvt. Ltd., 2011, Chapter.9, 10, 18 and 19. 4. Lehninger principles of Biochemistry, David L Nelson, Michael M.Cox, 3rd edition, MacMillan worth publishers, chapter-15,16,19 and 20.
UNIT III • **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	**10**	1. A text book of Biochemistry, AVSS Rama Rao, 9th edition, UBS Pubioshers and distributers, 2004, chapter-4, 5, 17, 24 and 26. 2. Biochemistry, U.Satyanarayana and U.Chakrapani, 4th edition, Elsevier & books and allied Pvt. Ltd., 2013, chapter-3, 4, 10, 14 & 15

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 (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia). Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline. Catabolism of heme; hyperbilirubinemia and jaundice		3. Medical Biochemistry, N.Mallikarjuna Rao, revised 2nd edition, new age International Pvt. Ltd., Publishers, 2007, chapter-3, 6, 10 and 12. 4. Text book of biochemistry for medical students, D M Vasudevan, sree kumari S, Kannan vaidhyanathan, 6th edition Jaypee brothers medical publishers pvt.Ltd., 2011, chapter-11, 13, 14, 17 and 21.
UNIT IV • **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	**10**	1. Text book of Biochemistry for medical students, D M Vasudavan, Sree Kumari S, Kannan Vaidyanathan, 6th edition, Jaypee brothers medical publishers, chapter-39, 40, 41 and 42. 2. Biochemistry, U.Satyanarayana and U.Chakrapani, 4th edition, Elsevier and books and allied Pvt. Ltd., 2013, chapter-5, 17, 24 and 25. 3. Medical biochemistry, N.Mallikarjuna Rao, revised 2nd edition, New Age international pvt. Ltd., publishers, 2007, chapter-14, 15, 16, 17 and 18.
UNIT V • **Enzymes** Introduction, properties, nomenclature and IUB classification of enzymes. Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples.	**07**	1. Biochemistry, U.Satyanarayana and U.Chakrapani, 4th edition, Elsevier & Books and allied Pvt. Ltd., 2013, chapter, 6, 7 & 18.

Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation. Therapeutic and diagnostic applications of enzymes and isoenzymes. Coenzymes –Structure and biochemical functions		2. A text book of Biochemistry, A V S S Rama Rao, 9th edition, VBS Publishers and distributers, 2004, chapter-9 and 11. 3. Text book of biochemistry for medical students, D M Vasudevan, sree kumari S, Kannan Vaidyanathan, 6th edition, Jaypee brothers medical publishers, 2001, chapter-40.

BP 204 T

BP204T-PATHOPHYSIOLOGY
THEORY (45 HOURS)

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 Outcomes:

C204.1	To understand the process of cell injury, morphology of cell injury and cellular adaptations.
C204.2	To understand the etiopathogenesis of cardiovascular, respiratory and renal diseases mentioned.
C204.3	To apply the principles of pathogenesis in understanding symptoms, signs and complications of disease states mentioned.
C204.4	To explain the etiopathogenesis of hematologic, endocrine, nervous, gastrointestinal, musculo skeletol diseases and Immunopathogenesis of infectious diseases.
C204.5	To appraise the principles of physical, chemical and biologic carcinogenesis.
C204.6	To adapt the principles of inflammation in understanding pathogenesis of various disease states.

Course content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I **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,	**10**	1.V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; 1997, pg.no.4 to 41 2. HarshMohan; Text book of Pathology; 6th edition; 2010, Pg.No.9

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		1.V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; 1997, pg.no.43 2. HarshMohan; Text book of Pathology; 6th edition; 2010, Pg.No.116
UNIT-II • **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.	**10**	1. HarshMohan; Text book of Pathology; 6th edition; 2010, Pg.No.399, 458, 463 & 640
UNIT-III • **Haematological Diseases:** Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, 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.	**10**	1.Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach 9th edition; 2014, Pg.No.1717 2. HarshMohan; Text book of Pathology; 6th edition; 2010, Pg.No.792 to 808 3.Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach 9th edition; 2014, Pg.No.979, 1033,353,1173, 1147 & 947

UNIT-IV • **Gastrointestinal system:** Peptic Ulcer, 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	**08**	1.Joseph Dipiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; 2014, Pg.No. 563, 607, 685 2.Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; 2014, Pg.No. 583, 1621 3. HarshMohan; Text book of Pathology; 6th edition; 2010, Pg.No.851
UNIT-V • **Infectious diseases:** Meningitis,Typhoid, Leprosy, Tuberculosis Urinary tract infections • **Sexually transmitted diseases:**AIDS, Syphilis, Gonorrhea	**07**	1.Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; 2003, Pg.No.584 2. Joseph Dipiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; 2014, Pg.No. 1825, 1931, 1995 3.Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; 2003, Pg.No.621 4. Adepu Ramesh, community pharmacy, Pg.No.97-114

BP 205 T

BP205T-COMPUTER APPLICATIONS IN PHARMACY
THEORY (30 HOURS)

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 Outcomes :

C205.1	To understand different types of databases, applications of computers and databases in pharmacy.
C205.2	To illustrate the concept of number system in computers.
C205.3	To make use of web technologies such as HTML, XML, CSS, programming languages, Web servers and pharmacy drug database.
C205.4	To appraise the applications of computers in pharmacy such as drug information services, pharmacokinetics, mathematical model in drug design, hospital and clinical pharmacy etc.,
C205.5	To explain about bioinformatics and its impact in vaccine discovery.
C205.6	To elaborate the applications of computers for data analysis in preclinical development.

Course content:

Chapter / Topic	Duration (Hrs.)	References
UNIT – I **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 : I**nformation gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	**06**	1.Computer fundamentals, pradeep K.Sinha, Priti Sinha, 3rd edition, BPB Publishers, Chapter 1, 2, 3. 2. Computer fundamentals with Pharmacy applications-N.K.Tiwarl, chapter 4. 3. Computers in pharmacy-Praveen S.thakur, Rachna manchanda, Pratibha Nand, Chapter 2, 3.

UNIT –II **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	**06**	1. Computer fundamentals with pharmacy applications- N K Tiwari-Chapter 10. 2.Computer education-Prof.Lalini Varanasi, Prof.V.Sudhakar, Dr.t.Mrunalini, 5th edition, Unit-III
UNIT – III **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.	**06**	1.Computer fundamentals with pharmacy applications-N K Tiwari-Chapter 12. 2.Computers in pharmacy-Praveen S.Thakur, Rachna Manchanda, Pratibha Nand, Chapter 11. 3.Computer fundamentals and C.Programmings pooja jain, S>Vikas publishers, 1st edition, 2009, Chapter 2, Unit-5.
UNIT – IV **Bioinformatics:** Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	**06**	Bioinformatics (Concept, skills and applications)-S.C.Rastogi-C B S publishers and distributors, 2nd edition, unit-1,8.
UNIT-V **Computers as data analysis in Preclinical development**: Chromatographic dada analysis(CDS), Laboratory Information management. System (LIMS) and Text Information Management System(TIMS)	**06**	Computer applications in pharmaceutical research and development-Sean ekins-wiley-inter science.

BP 206 T

BP206T-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 Outcomes :

C206.1	To extend basic knowledge on environment and its allied problems.
C206.2	To compare the natural, renewable and non renewable resources and the problems associated with them.
C206.3	To motivate the learners to participate in environment protection and improvement.
C206.4	To analyze the concepts of eco system including structure and functions.
C206.5	To adopt skills in identifying and solving environmental problems.
C206.6	To develop an attitude of concern for the environment.

Course content :

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I The Multidisciplinary nature of environmental studies Natural Resources. Renewable and non-renewable resources: Natural resources and associated problems 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.	**10**	1.Introduction to environmental science by Y.Anjaneyulu, B.S.Publishers, Unit 1-9. 2.Environmental studies-by Anubha Kaushik-C.P.Kaushik, 2nd edition, Unit 1, 2

UNIT-II 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)	**10**	1.Introduction to environmental science by Y.Anjaneyulu, B.S.Publishers, Unit :10. 2.Environmental studies by Anubha kaushik- C.P.Kaushik, 2nd edition, Unit-3. 3.A text book of environmental sciences by Purohit & Shamni, Agrawal, Unit-3.
UNIT- III Environmental Pollution: Air pollution; Water pollution; Soil pollution	**10**	1.Introdeuction to environmental science by Y.Anjaneyulu, B.S.publishers, unit-12-14. 2. Environmental studies- by Anubha Kaushik- C.D.Kaushik, 2nd edition, unit-5.

BP 207 P

BP207P-HUMAN ANATOMY AND PHYSIOLOGY
PRACTICAL (60 HOURS)

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**.**

Course Outcomes :

C207.1	To recall the physiology of special senses with the help of models, charts and specimens.
C207.2	To develop the knowledge on coordinating working of organs of various systems with the help of models, charts and specimens.
C207.3	To analyze the functions of cranial nerves by various sensory and motor functions.
C207.4	To evaluate body temperature and body mass index.
C207.5	To determine tidal volume and vital capacity.
C207.6	To assess the knowledge on family planning devices, pregnancy diagnostic tests, tissues of vital organs and gonads.

Course content :

S. No.	Chapter / Topic	Dura-tion (Hrs.)	References
01	To study the integumentary and special senses using specimen, models, etc.,	4	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, section-II
02	To study the nervous system using specimen, models, etc.,	4	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah Prakashan publications, section-II
03	To study the endocrine system using specimen, models, etc	4	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah Prakashan publications, section-II
04	To demonstrate the general neurological examination	5	A text book of practical physiology C.L.Ghai, 6th edition, Jaypee publications, section-IV, chapter-9.
05	To demonstrate the function of olfactory nerve	4	A text book of practical physiology. C.L.Ghai, 6th edition, Jaypee publications, section-IV, chapter-9

06	To examine the different types of taste.	4	A text book of practical physiology-C.L.Ghai, 6th edition, jaypee publications, section-IV, chapter-9.
07	To demonstrate the visual activity.	4	A textbook of practical physiology-C.L.Ghai, 6th edition, Jaypee publications, section-IV, chapter-10.
08	To demonstrate the reflex activity	4	A textbook of practical physiology-C.L.Ghai, 6th edition, Jaypee publications, section-IV, chapter-9.
09	Recording of body temperature	4	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edtion, B.S.Shah prakashan publications, section-II
10	To demonstrate positive and negative feedback mechanism.	4	A text book of practical physiology-C.L.Ghai, 6th edition, jaypee publications, section-IV, chapter.9
11	Determination of tidal volume and vital capacity.	3	Practical anatomy and physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, section-I, exp.no.10
12	Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.	4	Practical anatomy & physiology-Dr.R.K.Goyal, 11th edition, B.S.Shah prakashan publications, section-II
13	Recording of basal mass index.	3	A textbook of practical physiology-C.L.Ghai, 6th edition, Jaypee publications, section-I, exp.no.8
14	Study of family planning devices and pregnancy diagnosis test.	3	Essentials of medical physiology by K.Sembulingam and P.Sembulingam, Jaypee brothers medical publishers, section-7, pg.no.386.
15	Demonstration of total blood count by cell analyser	3	Hematology analyzer, lab medicine, vol.37 (5), may 2006.
16	Permanent slides of vital organs and gonads.	3	Physioex software.

BP 208 P

BP208P-PHARMACEUTICAL ORGANIC CHEMISTRY -I
PRACTICAL (60 HOURS)

Course Outcomes :

C208.1	To explain the preliminary qualitative analysis and molecular orbital structures of pharmaceutical organic compounds.
C208.2	To analyze unknown pharmaceutical organic compounds by determining their melting point/boiling point
C208.3	To explain the principle, mechanism and synthesize the different pharmaceutical compounds
C208.4	To find the presence of elements & functional groups of pharmaceutical compounds
C208.5	To appraise the rules concerned with reactivity, orientation of reactions and purification of organic compounds
C208.6	To find out the compound by systematic qualitative analysis

Course content :

S. No.	Name of the Experiment	Duration (hrs)	References
1	Systematic qualitative analysis of unknown organic compounds like		
a	Preliminary test: Color, odour, aliphatic/ aromatic compounds, saturation and unsaturation, etc.	3	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No.1290 to 1292 2. Practical Pharmaceutical Chemistry-II and viva-voce by N.Sharma, 17th edition, chapter-1, Pg.No.1 to 2. 3. Advanced practical organic chemistry by O.P.Agarwal, 17th edition, chapter-3, pg.no.19 to 23
b	Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test	3	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No.1204 to 1208 2. Practical Pharmaceutical Chemistry-II and viva-voce by N.Sharma, 17th edition, chapter-1, Pg.No.3 to 6. 3. Advanced practical organic chemistry by O.P.Agarwal, 17th edition, chapter-4, pg.no.24 to 29
c	Solubility test	3	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No.1198 to 1204

			2. Practical Pharmaceutical Chemistry-II and viva-voce by N.Sharma, 17th edition, chapter-1, Pg.No.2 to 3.
d	Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.	12	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No.1211 to 1233 2. Practical Pharmaceutical Chemistry-II and viva-voce by N.Sharma, 17th edition, chapter-2, Pg.No.7-18 3. Advanced practical organic chemistry by O.P.Agarwal, 17th edition, chapter-5, pg.no. 32 to 59
e	Melting point/Boiling point of organic compounds	3	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No 236, 241, 1197 to 1198 2. Advanced practical organic chemistry by O.P.Agarwal, 17th edition, chapter-6, pg.no.60 to 64
f	Identification of the unknown compound from the literature using melting point/ boiling point.	3	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No.1197
g	Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.	12	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No.1234 2. Practical Pharmaceutical Chemistry-II and viva-voce by N.Sharma, 17th edition, chapter-4, Pg.No.24to 67 3. Advanced practical organic chemistry by O.P.Agarwal, 17th edition, chapter-7, pg.no.65 to 89
h	Minimum 5 unknown organic compounds to be analysed systematically.	12	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No.1211 to 1233 2. Practical Pharmaceutical Chemistry-II and viva-voce by N.Sharma, 17th edition, chapter-2, Pg.No.7-18 3. Advanced practical organic chemistry by O.P.Agarwal, 17th edition, chapter-5, pg.no. 32 to 59

02	Preparation of suitable solid derivatives from organic compounds	6	1. Vogel text book of practical organic chemistry, 5th edition, Pg.No.1234 to 1286 2. Advanced practical organic chemistry by O.P.Agarwal, 17th edition, chapter-8, pg.no.90 to 213
03	Construction of molecular models	3	1. Organic chemistry by Morrison and Boyd, 6th edition. 2. Principles of Pharmaceutical Organic Chemistry by Rama Rao Nadendla, Unit-1.

BP 209 P

BP209P-BIOCHEMISTRY
PRACTICAL (60 HOURS)

Course Outcomes :

C209.1	To remember the qualitative analysis of carbohydrates and proteins
C209.2	To understand the principle and clinical significance of blood glucose
C209.3	To identify the amount of reducing sugars by DNSA method
C209.4	To examine the constituents present in Urine and their clinical significance
C209.5	To determine the effect of temperature and substrate concentration on salivary amylase activity
C209.6	To elaborate the clinical significance of creatinine, proteins and cholesterol in blood

Course content :

S. No.	Name of the Experiment	Durat-ion (hrs)	References
01	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)	**21**	Laboratory manual in Biochemistry by J.Jayaraman, Pg.No.49-52.
02	Identification tests for Proteins (albumin and Casein)	**06**	Pharmaceutical Biochemistry theory and practicals by P.K.Sharma, P.C.Dandiya, Pg.No.304.
03	Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)	**06**	An Introduction to practical biochemistry by David T.Plummer, Page No. 180.
04	Qualitative analysis of urine for abnormal constituents	**03**	Pharmaceutical Biochemistry theory and practicals by P.K.Sharma, P.C.Dandiya, Page No. 338.
05	Determination of blood creatinine	**03**	Pharmaceutical Biochemistry theory and practicals by P.K.Sharma, P.C.Dandiya, page No. 325.
06	Determination of blood sugar	**03**	Pharmaceutical Biochemistry theory and paracticals by P.K.Sharma, P.C.Dandiya, Page No. 310.

07	Determination of serum total cholesterol	**03**	Pharmaceutical Biochemistry theory and practicals by P.K.Sharma, P.C.Dandiya, Page No. 321.
08	Preparation of buffer solution and measurement of pH	**03**	Essentials of Physical Pharmacy by C V S Subrahmanyam, G.Vasantha Raju, Page No. 69-71, 315-320.
09	Study of enzymatic hydrolysis of starch	**03**	An introduction to practical biochemistry by David, T.Plummer, 3rd edition, page No. 182-186.
10	Determination of Salivary amylase activity	**03**	Laboratory manual in biochemistry by J.Jayaraman, page No.160.
11	Study the effect of Temperature on Salivary amylase activity.	**03**	An introduction to practical biochemistry by David. T.Plummer, 3rd edition, page No. 240-241.
12	Study the effect of substrate concentration on salivary amylase activity.	**03**	Laboratory manual in biochemistry by J.Jayaraman, page No. 125.

BP 210 P

BP210P-COMPUTER APPLICATIONS IN PHARMACY
PRACTICAL (30 HOURS)

Course Outcomes :

C210.1	To demonstrate and make use of MS Office, MS Word, MS Excel, MS Access and MS Power point.
C210.2	To understand the paradigms of program languages and be exposed to at least one language from each model, C and SQL.
C210.3	To summarize the report and printing the report from patient database
C210.4	To design a questionnaire using a word processing package to gather information about a particular disease.
C210.5	To create HTML web page to show personal information
C210.6	To create mailing labels Using Label Wizard , generating label in MS WORD

Course content :

S. No.	Name of the Experiment	Duration (hrs)	References
01	Design a questionnaire using a word processing package to gather information about a particular disease.	**3**	Computer fundamentals with Pharmacy applications-N.K.Tiwarl, chapter 4.
02	Create a HTML web page to show personal information.	**3**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-2:Chapter 2 (23-36) 2. Computer fundamentals with Pharmacy applications-N.K.Tiwarl, chapter 4.
03	Retrieve the information of a drug and its adverse effects using online tools	**3**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5:Chapter 1 (3-88) 2. Computer fundamentals with Pharmacy applications-N.K.Tiwarl, chapter 4.
04	Creating mailing labels Using Label Wizard , generating label in MS WORD	**2**	1. Computer fundamentals with Pharmacy applications-N.K. Tiwarl, chapter 4.

			2. Computer eduation – Prof. Lalini Varanasi, Prof.V. Sudhakar, Dr.T.Mrunalini: Neel kamal Publications Pvt Ltd:5th edition;2004, Unit – 3.
05	Create a database in MS Access to store the patient information with the required fields Using access	**2**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5 (3-88) 2.Computers in pharmacy-Praveen S.Thakur, Rachna Manchanda, Pratibha Nand, Chapter 11.
06	Design a form in MS Access to view, add, delete and modify the patient record in the database	**2**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5 (3-88) 2.Computers in pharmacy-Praveen S.Thakur, Rachna Manchanda, Pratibha Nand, Chapter 11.
07	Generating report and printing the report from patient database	**2**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5 (89-133) 2.Computer applications in pharmaceutical research and development-Sean ekins-wiley-inter science.
08	Creating invoice table using – MS Access	**3**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5 (89-133) 2. Computer eduation – Prof.Lalini Varanasi, Prof.V. Sudhakar, Dr.T.Mrunalini: Neel kamal Publications Pvt Ltd:5th edition;2004, Unit – 3
09	Drug information storage and retrieval using MS Access	**2**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5 (89-133)

			2. Computer eduation – Prof.Lalini Varanasi, Prof.V. Sudhakar, Dr.T.Mrunalini: Neel kamal Publications Pvt Ltd:5th edition;2004, Unit – 3
10	Creating and working with queries in MS Access	**2**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5 (89-133) 2. Computer eduation – Prof.Lalini Varanasi, Prof.V. Sudhakar, Dr.T.Mrunalini: Neelkamal Publications Pvt Ltd:5th edition;2004, Unit – 3
11	Exporting Tables, Queries, Forms and Reports to web pages	**3**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5 (89-133) 2. Computer eduation – Prof.Lalini Varanasi, Prof.V. Sudhakar, Dr.T.Mrunalini: Neelkamal Publications Pvt Ltd:5th edition;2004, Unit – 3
12	Exporting Tables, Queries, Forms and Reports to XML pages	**3**	1. Computer fundamentals and C programming -Pooja jain. S.Vikas publishers, 1st edition; 2009:Unit-5 (89-133) 2. Computer eduation – Prof.Lalini Varanasi, Prof.V. Sudhakar, Dr.T.Mrunalini: Neel kamal Publications Pvt Ltd:5th edition;2004, Unit – 3

BP 301 T

II/IV B.PHARMACY – 3RD SEMESTER
BP301T-PHARMACEUTICAL ORGANIC CHEMISTRY –II
(THEORY) - 45 Hours

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 organic chemical reaction, name of the reaction and orientation of reactions.
3. Account for reactivity/stability of compounds,
4. Prepare organic compounds

Course Outcomes :

C301.1	To understand about aromaticity, chemistry and reactions of benzene.
C301.2	To understand the concept of hydrolysis, hydrogenation, saponification and rancidity of oils.
C301.3	To gain knowledge on structure and medicinal uses of pharmaceutical organic compounds.
C301.4	To understand the concept of Baeyer's theory and Sachse Mohr's theory.
C301.5	To gain knowledge on chemistry of phenols, aromatic amines and aromatic acids.
C301.6	To estimate the analytical constants of fats and oils.

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

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I • **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	**10**	01. Organic Chemistry by IL Finar, Vol-I, 6th edition, Dorling Kindersley (India) Pvt.Ltd., 2008, Ch.20 02. Organic Chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley (India) Pvt. Ltd., 2008, Ch.14, 15 and 16.

b) Reactions of benzene - nitration, sulphonation, halogenations, 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		03. Principles of Pharmaceutical Organic Chemistry by Rama Rao Nadendla, Pharmamed press, 2014, Ch.16 and 17
UNIT - II • **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.	**10**	1. Organic Chemistry by IL Finar, Vol-I, 6th edition, Dorling Kindersley (India) Pvt.Ltd., 2008, Ch.23, 24 and 26 2. Organic Chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley (India) Pvt. Ltd., 2008, Ch.19, 20, 22, 23 and 24. 3. Principles of Pharmaceutical Organic Chemistry by Rama Rao Nadendla, Pharmamed press, 2014, Ch.20, 23 and 24.
UNIT - III • **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.	**10**	1 Organic Chemistry by IL Finar, Vol-I, 6th edition, Dorling Kindersley (India) Pvt.Ltd., 2008, Ch.11 2. Organic Chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley (India) Pvt.Ltd., 2008, Ch.33 . 3. Pharmaceutical Organic Chemistry, Part-I, Chemistry of Heterocyclic and natural compounds, Rama Rao Nadendla, 1st edition, vallabh publications, 2005, Ch.10
UNIT – IV • **Polynuclear hydrocarbons:** a. Synthesis, reactions	**8**	1. Organic Chemistry by IL Finar, Vol-I, 6th edition, Dorling Kindersley (India) Pvt.Ltd., 2008, Ch.29

b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives		2. Organic Chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley (India)Pvt.Ltd.,2008, Ch.16 3.Pharmaceutical Organic Chemistry, Part-I, Chemistry of Heterocyclic and natural compounds, Rama Rao Nadendla, 1st edition, vallabh publications, 2005, Ch.2
UNIT – V • **Cyclo alkanes*** 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.	**7**	1. Organic Chemistry by IL Finar, Vol-I, 6th edition, Dorling Kindersley (India) Pvt.Ltd., 2008, Ch.19 2. Organic Chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley (India) Pvt. Ltd., 2008, Ch.13. 3. Principles of Pharmaceutical Organic Chemistry by Rama Rao Nadendla, Pharmamed press, 2014, Ch.12

BP 302 T

II/IV B.PHARMACY – 3RD SEMESTER
BP302T-PHYSICAL PHARMACEUTICS-I
(THEORY) 45 Hours

Scope: The course deals with the various 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 Outcomes :

C302.1	To recollect the states of matter and understand the applications of various physiochemical properties to design dosage forms.
C302.2	To gain knowledge of pH and buffers and their use in the stabilization of pharmaceutical formulations.
C302.3	To understand the principle of interfacial tension and the applications of surface active agents in drug solubilization.
C302.4	To describe the principles of diffusion in biological systems.
C302.5	To perceive and apply the concepts of complexation and protein binding in pharmacy.
C302.6	To elaborate the significance of physical properties of drug molecules in design and stability of dosage forms.

Course Content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I **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	**10**	1. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2. Peter Atkins, Elements of Physical Chemistry. Fourth edition, oxford university press, New York. 3. Raymond Chang. Essential Chemistry,

solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications		International edition, McGraw Hill. 4. Remington. The science and practice of pharmacy, 22nd Ed., Philadelphia. 5. Cooper and Gunn's. Tutorial pharmacy, S.J.Carter, 1st Edition. 6. Harry G.Brittain Polymorphism in Pharmaceutical Solids, Marcel Dekker, Inc. New York.
UNIT-II **States of Matter and properties of matter:** State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous & polymorphism. **Physicochemical properties of drug molecules:** Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications	**10**	1.Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2. Raymond Chang. Essential Chemistry, International edition, McGraw Hill.
UNIT-III **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, solubilisation, detergency, adsorption at solid interface.	**10**	1. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2.Peter Atkins. Elements of Physical Chemistry, 4th Edition, Oxford Universitypress, New York 3.Raymond Chang. Essential Chemistry, International edition, McGraw Hill. 4.Remington. The science and Practice of Pharmacy, 22nd Ed., Philadelphia.

UNIT-IV **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.	**08**	1. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2. Remington. The science and practice of pharmacy, 22nd Ed., Philadelphia.
UNIT-V **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.	**07**	1.Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & wilkins, Philadelphia. 2.Raymond Chang. Essential Chemistry, International edition, McGraw Hill. 3.James Swarbrkck. Encyclopaedia of Pharmaceutical technology. 2nd edition, Marcel Dekker Inc, Newyork. Vol.3

BP 303 T

II/IV B.PHARMACY – 3RD SEMESTER
BP303T-PHARMACEUTICAL MICROBIOLOGY
(THEORY) 45 Hours

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

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

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

Course Outcomes :

C303.1	To remember the scope of microbiology and its branches, methods of classification.
C303.2	To understand the importance and implementation of sterilization in pharmaceutical processing and industry.
C303.3	To utilize the knowledge in identification, cultivation and preservation of various microorganisms.
C303.4	To test for the microbiological standardization of pharmaceuticals.
C303.5	To choose the cell culture technology and microbial characters for the pharmaceutical industry.
C303.6	To compile the microbiological testing protocols.

Course Content:

Chapter / Topic	Duration (Hrs.)	References
Unit- I Introduction, history of microbiology, its branches, scope and its importance. a) Introduction to Prokaryotes and Eukaryotes. b) Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth,	**10**	1. Prescott's Microbiology, J.M.Willey, L.M.Sherwood, C.J.Woolverston, 8th Edition, McGraw Hill international, 2011. 2. Microbiology, M.J.Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill, 5th edition.

growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). c) Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.		
Unit-II a) Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). b) Study of principle, procedure, merits, demerits and applications of physical, chemical and mechanical method of sterilization. c) Evaluation of the efficiency of sterilization methods. d) Equipments employed in large scale sterilization. Sterility indicators.	**10**	1. Prescott's Microbiology, J.M.Willey, L.M.Sherwood, C.J.Woolverston, 8th Edition, McGraw Hill international, 2011. 2. Microbiology, M.J.Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill, 5th edition. 3. Cooper and Gunn's Tutorial pharmacy, S.J.Carter, 12th edition. CBS Publishers, 2005. 4. Indian Pharmacopeia 2004, the Indian Pharmaceutical commission Ghaziabad.
Unit - III a) Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. b) Classification and mode of action of disinfectants. c) Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions d) Evaluation of bactericidal & Bacteriostatic. e) Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.	**10**	1. Prescott's Microbiology, J.M.Willey, L.M.Sherwood, C.J.Woolverston, 8th Edition, McGraw Hill international, 2011. 2. Microbiology, M.J.Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill, 5th edition. 3. Cooper and Gunn's Tutorial pharmacy, S.J.Carter, 12th edition. CBS Publishers, 2005. 4.Pharmaceutical biotechnology, S.P.Vyas, V.K.Dixit, CBS publications, 2007
Unit IV Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.	**08**	1. Cooper and Gunn's Tutorial pharmacy, S.J.Carter, 12th edition. CBS Publishers, 2005. 2. Remington, the science and practice of pharmacy, pharmaceutical press published, edition 22, 2006.

a) Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. b) Assessment of a new antibiotic and testing of antimicrobial activity of a new substance. c) General aspects-environmental cleanliness.		
Unit-V a) Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. b) Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. c) Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. d) Application of cell cultures in pharmaceutical industry and research.	**07**	1. Cooper and Gunn's Tutorial pharmacy, S.J.Carter, 12th edition. CBS Publishers, 2005. 2.Indian Pharmacopeia 2004, the Indian Pharmacopeia commission Ghaziabad.

BP 304 T

II/IV B.PHARMACY – 3RD SEMESTER
BP304T-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 Outcomes :

C304.1	To classify and explain various unit operations involved in manufacturing of pharmaceuticals.
C304.2	To understand the concepts of flow of fluids, size reduction and size separation.
C304.3	To summarize different mechanisms of heat transfer.
C304.4	To compare and contrast different types of evaporation and distillation process.
C304.5	To determine the factors influencing mixing, filtration and centrifugation.
C304.6	To elaborate various preventive methods used for corrosion control in pharmaceutical industries.

Course Content:

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I • **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.	**10**	1. Introduction to chemical engineering – Walter L Badger and Julius Banchero, 11th edition, tata Mc Graw Hill publishing Ltd., New Delhi, India, 2004. 2. Cooper and Gunn's Tutorial Pharmacy, 6th edition, S.J.Carter, CBS Publishers and distributors, New Delhi, India, 2005. 3. Aulton's Pharmaceutics-

• **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.		The design and manufacture of medicines. Aulton and Taylor. 3rd edition, Churchill Living stone Elsevier, Philadelphia, USA, 2009.
UNIT-II • **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	**10**	1. Introduction to chemical engineering – Walter L Badger and Julius Banchero, 11th edition, tata Mc Graw Hill publishing Ltd., New Delhi, India, 2004. 2. Cooper and Gunn's Tutorial Pharmacy, 6th edition, S.J.Carter, CBS Publishers and distributors, New Delhi, India, 2005. 3. Pharmaceutical Engineering : Unit operations-I C.V.S.Subrahmanyam, 2nd edition, Vallabh Prakashan, New Delhi, 2011. 4. Chemical Engineers Handbook. Robert H.Perry and Cecil H.Chilton, Latest Edition, Mc Graw Hill Kogakusha, Toko, Japan, 1973
UNIT- III • **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.	**09**	1.Introduction to chemical engineering-Walter L.Badger & Julius Banchero, 11th edition, Tata Mc Graw Hill publishing ltd., New Delhi, India, 2004. 2. Cooper and Gunn's Tutorial pharmacy, 6th edition, S.J.Carter, CBS Publishers and distributors, New Delhi, India, 2005.

• **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.		3. Aulton's Pharmaceutics-The design and manufacture of medicines. Aulton and Taylor, 3rd edition, Churchill Living stone Elsevier, Philadelphia, USA, 2009.
UNIT-IV • **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.	**08**	1.Pharmaceutical engineering. K.Samba-murthy, Latest edition, New age international Pvt, Ltd., New Delhi, 2005 2. Pharmaceutical Engineering: Unit Operations-I C.V.S. Subrahmanyam, 2nd edition, vallabh prakashan, New Delhi, 2011. 3. Cooper and Gunn's Tutorial pharmacy, 6th edition, S.J.Carter, CBS publishers and distributors, New Delhi, India, 2005. 4. Introduction to chemical engineering-Walter L Badger and Julius banchero, 11th edition, Tata Mc Graw Hill publishing ltd., New Delhi, India, 2004.
UNIT- V • **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.	**08**	1. Cooper and Gunn's Tutorial pharmacy, 6th edition, S.J.Carter, CBS publishers and distributors, New Delhi, India, 2005. 2. Aulton's Pharmaceutics-The design and manufacture of medicines. Aulton and Taylor, 3rd edition, Churchill Living stone Elsevier, Philadelphia, USA, 2009. 3. Chemical Engineers handbook. Robert H.Perry and Cecil H.Chilton. Latest Edition, Mc Graw Hill Kogakusha, Toko, Japan, 1973.

BP 305 T

II/IV B.PHARMACY – 3RD SEMESTER
BP305T-PROFESSIONAL ETHICS AND HUMAN VALUES
(THEORY) (30 HOURS)

Scope of the Subject :

1.To bring awareness among pharmacy graduates on ethics and human values.
2. to understand and ethical theories and their application to work ethics.
3. To know various codes of ethics used by professional bodies.
4. To understand the concepts of corruption and its measures.
5. To learn about professional responsibility as a pharmacist.

Outcomes of the subject :

The student will be able to :
a) Develop awareness on ethics and human values
b) Become morally and socially responsible.
c) Motivate others on moral values.

Course Outcome :

C305.1	To remember and recall the human values and professional ethics.
C305.2	To outline the ethical norms, anti corruption measures and central vigilance bodies.
C305.3	To apply moral concepts and reasoning in pharmacy.
C305.4	To discover ethical issues in clinical pharmacy practice and manufacturing of pharmaceutical products.
C305.5	To appraise professional societies and various pharmaceutical associations.
C305.6	To adapt social pharmacy and code of pharmaceutical ethics.

Course Content:

TOPIC	Duration (hrs)	References
UNIT-I Human Values: Morals, Values and ethics-Integrity-Work ethics-Service learning, Civic virtue, Respect for others, Living Peacefully-Caring, Sharing, Honesty, Courage, Valuing time, Co-operations,Commitment, Empathy, Self confidence, Character and Spirituality.	**04**	R.S.Naagarazan professional ethics and Human values edition I, New Age International Pvt. Ltd., edition -1, Chapter-1
UNIT-II **Introduction to professional ethics, corruption and its measures:** Need of ethics in pharmacy, changing times, RPSGB guidance, ethical norms, moral relativism, facts and values, ethical theories and concepts. Corruption in	**05**	Joy Wingfield and David Badcott, Pharmacy ethics and decision making, Pharmaceutical press, Edition I, Chapter-I.

public life, economic impact of corruption, payments that equate supply and demand; bribes as incentive payments, bribes to reduce costs, organized crime and corruption. Anti-corruption measures – Anti corruption Bureau (ACB), Central Vigilance Commission (CVC), Central Bureau of Investigation (CBI), lokadalats, Ombudsman, Comptroller and auditor general (CAG) and right to information.		
UNIT-III **Moral concepts and reasoning in Pharmacy:** Moral issues, rational inquires, moral autonomy, moral reasoning and pharmacist, moral development theories, justice and human rights, trust and truthfulness and moral dilemmas	**05**	1.R.S.Naagarazan professional ethics and Human values edition I, New Age International Pvt. Ltd., edition -1, Chapter-2 2.Joy Wingfield and David Badcott, Pharmacy ethics and decision making, Pharmaceutical press, Edition I, Chapter-4.
UNIT-IV **Professionalism and Industrial ethics:** Pharmacy and professionalism, ethical basis in professionalism and accountability, industrial ethics, pharmacist in different clusters with different ethical issues – ethical issues in clinical pharmacy practice, community pharmacy and manufacturing of pharmaceutical products.	**05**	1.Joy Wingfield and David Badcott, Pharmacy ethics and decision making, Pharmaceutical press, Edition I, Chapter-4 2.R.S.Naagarazan professional ethics and Human values edition I, New Age International Pvt. Ltd., edition -1, Chapter-2
UNIT-V **Professional societies and various pharmaceutical associations:** Indian Pharmaceutical Congress Association, Indian Pharmaceutical Association, Indian Hospital Pharmacists Association, Indian Pharmacy Graduates Association, Association of Pharmaceutical Teachers of India, The All India Drug Control Officers Confederation, Indian Society for Technical Education, National Pharmaceutical Pricing Authority and other allied professional societies/associations.	**06**	1.Professional Pharmacy-M.L.Schroff 2. Harikishan Singh: History of Pharmacy in India and related aspects, Volume-I, II and III Pharmacopoeias and formularies, 1st Edition, Vallabh Prakashan, 2005

UNIT-V **Social Pharmacy and code of Pharmaceutical ethics:** The Concept and context of social pharmacy, principles of ethics, Mrality, ethical codes, Pharmaceutical Ethics in relation to job, trade, profession and medical profession. Pharmacist Oath.	**05**	1.N.K.Jain, Forensic Pharmacy, Eight edition, 2014, 484-492. 2.B.M.Mithal, A Text book of Forensic Pharmacy, Valla Prakasan, 10th edition, Chapter-14

Further Readings:

01. NK Jain, Health Education and community Pharmacyby , CBS, Publ. and Distributors, New Delhi.
02. R.M.Metha, Dispensing pharmacy
03. Pharmacoethics: A problem based approach by G.Vidya Sagar
04. Gupta AK, Health Education and Community Pharmacy, CBS, Publ. and Distribution, New Delhi.

BP 305 P

II/IV B.PHARMACY – 3RD SEMESTER
BP305P-PHARMACEUTICAL ORGANIC CHEMISTRY -II
(PRACTICAL) 60 Hrs/week

Course Outcomes :

C305.1	To gain the knowledge on different recrystalization and steam distillation techniques.
C305.2	To remember and recall the different laboratory techniques used in pharmaceutical chemistry.
C305.3	To identify the purity of fats and oils by acid value, saponification value and iodine value.
C305.4	To perform various reaction like diazotization, oxidation reactions.
C305.5	To analyze named reactions like perkin and claisen schmidt reactions by using carbonyl compounds.
C305.6	To test the knowledge on different electrophilic aromatic substitutions reactions like bromination, nitration in monosubstituted aromatic compounds.

Course Content:

S. No.	Name of the Experiment	Durat-ion (hrs)	References
I	Experiments involving laboratory techniques • Recrystallization • Steam distillation	**6**	Practical Organic Chemistry by F.G.Mann and B.C. Saunders, 4th edition, Pg. No. 13 and 32.
II	Determination of following oil values (including standardization of reagents) • Acid value • Saponification value • Iodine value	 **4** **4** **4**	• Indian Pharmacopoeia, 2018, Vol.I, Pg.No.142 • Indian Pharmacopoeia, 2018, Vol.I, Pg.No.151 • Indian Pharmacoporia, 2018, Vol.I, Pg.No.144
III	**Preparation of compounds**		
1	Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.	**4**	Practical organic chemistry by F.G.Mann and B.C.Saunders, 4th edition, page No. 108.
2	2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline.	**4**	Practical organic chemistry by F.G.Mann and B.C.Saunders, 4th edition, page No. 165.
3	Acetanilide by halogenation (Bromination) reaction.	**6**	Text book of practical organic chemistry by Vogel's, 5th edition, page No. 918.

4	5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid /Nitro benzene by nitration reaction.	**6**	Text book of practical organic chemistry by Vogel's, 5th edition, page No. 855.
5	Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.	**4**	home.miracosta.edu/dlr/211exp3.htm.
6	1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.	**4**	Text book of practical organic chemistry by Vogel's, 5th edition, page No. 948.
7	Benzil from Benzoin by oxidation reaction.	**4**	Practical organic chemistry by F.G.Mann and B.C.Saunders, 4th edition, page No. 234.
8	Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction.	**4**	Practical organic chemistry by F.G.Mann and B.C.Saunders, 4th edition, page No. 231.
9	Cinnammic acid from Benzaldehyde by Perkin reaction.	**3**	Text book of practical organic chemistry by Vogel's, 5th edition, page No. 1038.
10	*P*-Iodo benzoic acid from *P*-amino benzoic acid.	**3**	Systematic lab experiments in organic chemistry by Arun Sethi, page No. 777

Recommended Books (Latest Editions)

1. Organic Chemistry byMorrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry byMann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

BP 306 P

II/IV B.PHARMACY – 3RD SEMESTER
BP306P-PHYSICAL PHARMACEUTICS – I
(PRACTICAL) 60 Hours

Course Outcomes :

C306.1	To understand the significance of physical properties such as solubility, surface tension, partition coefficient and pK_a in the design of dosage forms.
C306.2	To explain adsorption isotherms and determine Freundlich-Langmuir constant using activated charcoal.
C306.3	To apply Henderson – Hasselbalch equation for interpretation of pK_a value of drugs.
C306.4	To determine the surface tension of sample liquids by drop count and drop weight methods
C306.5	To deduce the HLB value and critical micellar concentration of a surfactant.
C306.6	To estimate the stability constants of complexes by solubility and pH titration methods.

Course Content:

S. No.	Chapter / Topic	Dura-tion (Hrs.)	References
1	Determination the solubility of drug at room temperature	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
2	Determination of pKa value by Half Neutralization / Henderson Hassel-balch equation.	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
3	Determination of Partition co- efficient of benzoic acid in benzene and water	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
4	Determination of Partition co- efficient of Iodine in CCl4 and water	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
5	Determination of % composition of NaCl in a solution using phenol-water system by CST method	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
6	Determination of surface tension of given liquids by drop count and drop weight method	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee

7	Determination of HLB number of a surfactant by saponification method	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
8	Determination of Freundlich and Langmuir constants using activated char coal	08	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
9	Determination of critical micellar concentration of surfactants	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
10	Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
11	Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method	04	Laboratory Manual of Physical Pharmaceutics, C.V.S. subramanyam, J.Thimma settee
12	Construction of ternary phase diagram	08	Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia.
13	Determination of electromotive force	04	Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia.

BP 307 P

II/IV B.PHARMACY – 3RD SEMESTER
BP307P-PHARMACEUTICAL MICROBIOLOGY
(PRACTICAL) 60 Hrs/week

Course Outcomes :

C307.1	To recall different techniques of sterilization.
C307.2	To demonstrate various staining methods – simple, gram staining and acid fast staining.
C307.3	To interpret the results of microbial testing.
C307.4	To test for possible microbial contaminants.
C307.5	To estimate the amount of biomass in the given sample.
C307.6	To choose the correct method to evaluate the microbes to be tested.

Course Content:

S. No.	Chapter / Topic	Dura-tion (Hrs.)	References
1	General rules and procedure in microbiology lab	4	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.
2	**Sterilization techniques:** Sterilization by moist heat-(autoclave-steam under pressure), Sterilization by dry heat-hot air oven, red hot, flaming, Sterilization by gases-fumigation by formaldehyde. (glass ware, preparation and media.	4	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.
3	**Sub culturing of bacteria and fungus:** Preparation of culture medium for bacteria-nutrient agar, nutrient broth. Preparation of culture medium for fungi-dexrose agar, dextrose broth, starch agar.	8	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.
4	**Microscopic observation and identification:** Simple staining Gram staining Acid-fast staining Negative Staining Spore Staining Microscopic observation of fungi	12	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.

5	**Study of Bacterial Motility:** Hanging drop technique	4	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.
6	**Isolation and quantification of microbes:** Isolation of pure cultures by streak plate method; viable count of microbes of serial dilution method, Presumptive test.	8	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.
7	**Microbiological assays:** Micro biological assay of pencillin by cup plate method Micro biological assay of tetracyclic by turbidometric method.	8	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.
8	Bacteriological analysis of water	4	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.
9	Biochemical characterization of microbes IMViC tests**: Indole test Methyl red test, voges proskaurer test, Citrate utilization test	4	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.
10	Determination of most probable number (MPN) for water analysis	4	Cappuccino Sherman. Microbiology A Laboratory Manual, 6th Edition, Pearson education (Singapore) Pte. Ltd., India, 2004.

BP 308 P

II/IV B.PHARMACY – 3RD SEMESTER
BP308P-PHARMACEUTICAL ENGINEERING
(PRACTICAL) 60 Hours/week

Course Outcomes :

C308.1	To understand the basic principles involved in unit operations such as size reduction, size separation, distillation and drying.
C308.2	To demonstrate and explain about the construction, working and applications of pharmaceutical equipments such as colloid mill, planetary mixer, fluidized bed dryer and freeze dryer.
C308.3	To experiment with the process variables of filtration, evaporation and infer the same.
C308.4	To determine radiation constant of brass, iron, unpainted and painted glass.
C308.5	To determine overall heat transfer coefficient by heat exchanger and calculate the efficiency of steam distillation.
C308.6	To estimate moisture content, loss on drying and construct drying curves for calcium carbonate and starch.

Course Content:

S. No.	Chapter / Topic	Dura-tion (Hrs.)	References
1	Determination of radiation constant of brass, iron, unpainted and painted glass.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.1-9
2	Steam distillation – To calculate the efficiency of steam distillation.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.103-107
3	To determine the overall heat transfer coefficient by heat exchanger.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.15-21
4	Construction of drying curves (for calcium carbonate and starch).	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.133-138
5	Determination of moisture content and loss on drying.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.139-149

6	Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.127-131
7	Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.	8	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.27-34
8	Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications
9	Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.76-89
10	Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.	8	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications
11	Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications
12	To study the effect of time on the Rate of Crystallization.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.122-126
13	To calculate the uniformity Index for given sample by using Double Cone Blender.	4	Laboratory manual of Pharmaceutical Engineering by C.V.S.Subrahmanyam, 2nd Edition, Vallabh Publications, Pg.No.60-63

II B.PHARMACY
4th SEMESTER

BP 401 T

II/IV B.PHARMACY – 4th SEMESTER
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 Outcomes :

C401.1	To understand the fundamentals of stereo chemical aspects
C401.2	To discuss optical isomerism-optical activity, enantiomerism, diastereoisomerism and meso compounds.
C401.3	To explain stereo isomerism in biphenyl compounds (atropisomerism) and conditions for optical activity.
C401.4	To understand the nomenclature, properties and methods of preparation of heterocyclic compounds.
C401.5	To identify medicinal uses and other applications of organic compounds.
C401.6	To elaborate the reactions and synthetic importance of metal hydride reduction ($NaBH_4$ & $LiAlH_4$), Clemmensen reduction, Oppenauer oxidation, Dakin's reaction, wolf-Kishner reduction, Schmidt rearrangement, Claisen condensation and Beckmann rearrangement.

Course Content:

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

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT-I **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	**10**	1. Organic chemistry, IL. Finar, 5th edition, volume-II, Dorling Kindersley (India) Pvt. Ltd. 2008, Ch.2 and volume-I, chapter- 17 2.Organic chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley (India) Pvt. Ltd. 2008, chapter-4

of racemic mixture. Asymmetric synthesis: partial and absolute		3. Organic chemistry reactions and reagents, O P Agrawal, 44th edition, Krishna Prakashan media (p) Ltd, 2008, chapter-6 4.Organic reactions, stereochemistry and mechanism, P S Kalsi, 4th edition, New age International publishers, 2007, chapter-2 and 3 5. Principles of pharmaceutical organic chemistry, Rama Rao Nadendla, Pharma Med Press, 2014, chapter-7. 6. Pharmaceutical organic chemistry, part-1, Chemistry of heterocyclic and natural compounds, Rama Rao Nadendla, 1st edition, Vallabh publication, 2005, chapter-5.
UNIT-II Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, 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	**10**	1. Organic chemistry, IL. Finar, 5th edition, volume-II, Dorling Kindersley(India) Pvt. Ltd. 2008, Ch.4, 5. 2. Organic chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley(India) Pvt. Ltd. 2008, chapter-4 and 10 3. Organic chemistry reactions and reagents, O P Agrawal, 44th edition, Krishna Prakashan media (p) Ltd, 2008, chapter-6 4.Principles of pharmaceutical organic chemistry, Rama Rao Nadendla, Pharma Med Press, 2014, chapter-7 5. Pharmaceutical organic chemistry, part-1, Chemistry of heterocyclic and natural compounds, Rama Rao Nadendla, 1st edition, Vallabh publication, 2005, chapter-5.

UNIT-III **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	**10**	1. Principles of pharmaceutical organic chemistry, Rama Rao Nadendla, Pharma Med Press, 2014, chapter-25 2. Pharmaceutical organic chemistry, part-1, Chemistry of heterocyclic and natural compounds, Rama Rao Nadendla, 1st edition, Vallabh publication, 2005, chapter-7 3.Organic chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley(India) Pvt. Ltd. 2008, chapter-30 4. Organic chemistry reactions and reagents, O P Agrawal, 44th edition, Krishna Prakashan media (p) Ltd, 2008, chapter-19 5. Heterocyclic chemistry, Raj K Bansal, 4th edition, New age international (P) Limited, 2007, chapter-5. 6. Organic reactions, stereochemistry and mechanism, P S Kalsi, 4th edition, New age International publishers, 2007, chapter-8
UNIT-IV 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	**08**	1. Principles of pharmaceutical organic chemistry, Rama Rao Nadendla, Pharma Med Press, 2014, chapter-7 2.Organic chemistry, IL. Finar, 5th edition, volume-II, Dorling Kindersley(India) Pvt. Ltd. 2008, Ch.12 3.Organic chemistry, Robert Thornton Morrison, Robert Neilson Boyd, 6th edition, Dorling Kindersley(India) Pvt. Ltd. 2008, chapter-30

		4. Organic chemistry reactions and reagents, O P Agrawal, 44th edition, Krishna Prakashan media (p) Ltd, 2008, chapter-19 5. Heterocyclic chemistry, Raj K Bansal, 4th edition, New age international (P) Limited, 2007, chapter-6, 7, 8 and 10. 6. Organic reactions, stereochemistry and mechanism, P S Kalsi, 4th edition, New age International publishers, 2007, chapter-8
UNIT-V **Reactions of synthetic importance** Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation	**07**	1.Organic reactions and mechanisms, BK Ahluwalia, Rakesh Kumar parashar, 3rd edition, Narose publishing house, Pvt. Ltd., 2007, Chapter 5 and 6. 2. Pharmaceutical organic chemistry, Part-I, Chemistry of heterocyclic and natural compounds, Rama Rao Nadendla, 1st edition, vallabh publications, 2005, chapter-4. 3.Organic chemistry reactions and reagents, O P Agrawal, 44th edition, Krishna Prakashan media (p) ltd., 2008, chapter-16, 20 and 21.

Recommended Books (Latest Editions)

1. Organic chemistry by I.L. Finar, Volume-I & II.
2. A text book of organic chemistry – Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal
4. Organic Chemistry byMorrison and Boyd
5. Heterocyclic Chemistry by T.L. Gilchrist

BP 402 T

II/IV B.PHARMACY – 4th SEMESTER
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 Outcomes :

C402.1	To recall the various classes of medicinal compounds
C402.2	To explain the physicochemical properties, steric aspects of drugs and their metabolic pathways
C402.3	To identify the structural requirements of drugs to elicit biological response
C402.4	To categorize the drugs based on their mechanism of action and clinical uses
C402.5	To design the synthetic routes for medicinal compounds.
C402.6	To choose the appropriate medicinal compound for treatment of disease or disorder

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 (*)

Chapter / Topic	Dura-tion (Hrs.)	References
UNIT- I **Introduction to Medicinal Chemistry History and development of medicinal chemistry** **Physicochemical properties in relation to biological action** Ionization, Solubility, Partition	**10**	1. Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and wilkins,

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.		2004, Ch.2 and 3 2.Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A.Williams, Wolters Kluwer, 2008, 6th edition, Ch.2, 3, 4 and 10. 3.Medicinal chemistry, Rama Rao Nadendla, 2nd edition, Pharma med press, 2013, Ch.2 and 3. 4. An introduction to medicinal chemistry, Graham L.Patrick, 3rd edition, Oxford University press, part A-2.
UNIT- II **Drugs acting on Autonomic Nervous System Adrenergic Neuro-transmitters:** Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. **Sympathomimetic agents: SAR of Sympathomimetic agents** **Direct acting:** Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. • Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. • Agents with mixed mechanism: Ephedrine, Metaraminol. **Adrenergic Antagonists:** **Alpha adrenergic blockers:** Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. **Beta adrenergic blockers:** SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.	**10**	1. Wilson and Grisvold's textbook of organic medicinal and pharma-ceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and wilkins, 2004, Ch.15 and 16 2. Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A. Williams, Wolters Kluwer, 2008, 6th edition, Ch.13. 3. Principles of Organic Medicinal Chemistry by Rama Rao Nadendla, New age international limited, 2007, Ch.11 and 12. 4. An introduction to medicinal chemistry, Graham L.Patrick, 3rd edition, Oxford University press, part C-20.

UNIT-III **Cholinergic neurotransmitters:** Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution. **Parasympathomimetic agents: SAR of Parasympathomimetic agents** **Direct acting agents:** Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine. **Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):** Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion. **Cholinesterase reactivator:** Pralidoxime chloride. **Cholinergic Blocking agents: SAR of cholinolytic agents** **Solanaceous alkaloids and analogues:** Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*. **Synthetic cholinergic blocking agents:** Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.	**10**	1. Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and wilkins, 2004, chapter.17. 2.Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A.Williams, Wolters Kluwer, 2008, 6th edition, chapter.12. 3.Principles of Organic Medicinal Chemistry by Rama Rao Nadendla, New age international limited, 2007, chapter.10. 4.An introduction to medicinal chemistry, Graham L.Patrick, 3rd edition, Oxford University press, part chapter.19.

UNIT- IV **Drugs acting on Central Nervous System** **A. Sedatives and Hypnotics:** **Benzodiazepines:** SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem **Barbiturtes:** SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital **Miscelleneous:** Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde. **B. Antipsychotics** **Phenothiazeines:** SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride. **Ring Analogues of Phenothiazeines:** Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine. **Fluro buterophenones:** Haloperidol, Droperidol, Risperidone. **Beta amino ketones:** Molindone hydrochloride. **Benzamides:** Sulpieride. **C. Anticonvulsants:** SAR of Anticonvulsants**,** mechanism of anticonvulsant action **Barbiturates**: Phenobarbitone, Methabarbital.	**08**	1. Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and wilkins, 2004, chapters 14 and 15. 2.Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A.Williams, Wolters Kluwer, 2008, 6th edition, chapters 19, 20, 22 and 25. 3.Principles of Organic Medicinal Chemistry by Rama Rao Nadendla, New age international limited, 2007, chapters.7, 8 and 9.

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:**Trimethadione, Paramethadione **Succinimides:**Phensuximide, Methsuximide, Ethosuximide* **Urea and monoacylureas**: Phenacemide, Carbamazepine* **Benzodiazepines**: Clonazepam **Miscellaneous:** Primidone, Valproic acid , Gabapentin, Felbamate		
UNIT – V **Drugs acting on Central Nervous System** **General anesthetics:** **Inhalation anesthetics:** Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane. **Ultra short acting barbitutrates:** 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, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate. **Narcotic antagonists:** Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride. **Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.	**07**	1.Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and wilkins, 2004, chapters.14, 15, 20 and 22. 2.Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A.Williams, Wolters Kluwer, 2008, 6th edition, chapters.18 and 24. 3.Principles of Organic Medicinal Chemistry by Rama Rao Nadendla, Newage international limited, 2007, chapters.6, 15 and 16. 4. An introduction to medicinal chemistry, Graham L.Patrick, 3rd edition, Oxford University press, part D-21.

BP 403 T

II/IV B.PHARMACY – 4th SEMESTER
BP403T-PHYSICAL PHARMACEUTICS-II
(THEORY) 45 Hours

Scope: The course deals with the various 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 Outcomes :

C403.1	To introduce and categorize the dispersed systems and understand the properties and applications of colloidal dispersions.
C403.2	To make the use of principles of kinetics in the stabilization of dosage forms.
C403.3	To interpret the rheological behavior of fluids and illustrate the physics of tablet compression.
C403.4	To determine the properties of powders and apply them in formulation development.
C403.5	To formulate and evaluate coarse dispersions making use of rheological and electrical properties.
C403.6	To discuss the importance of zeta potential in the stabilization of dispersed systems.

Course Content:

Chapter / Topic	Duration (Hrs.)	References
UNIT-I **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.	**05**	1.Martin's Physical Pharmacy and Pharmaceutical Sciences, 5th Edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2. Peter Atkins, elements of Physical Chemistry. 4th Edition, Oxford university press, New York. 3.Remington. The science and practice of pharmacy, 22nd edition, Philadelphia.

		4.Cooper and Gunn's, Tutorial pharmacy, S.J.Carter, 1st Edition. 5.Harry G.Brittain Polymorphism in Pharmaceutical Solids, marcel Dekker, Inc. New York.
UNIT-II **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.	**10**	1.Martin's Physical Pharmacy and Pharmaceutical Sciences, 5th Edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2.Raymond Chang.Essential Chemistry, International edition, McGraw Hill.
UNIT-III **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.	**10**	1.Martin's Physical Pharmacy and Pharmaceutical Sciences, 5th Edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2. Peter Atkins, elements of Physical Chemistry. 4th Edition, Oxford university press, New York. 3.Raymond Chang.Essential Chemistry, International edition, McGraw Hill.
UNIT-IV **Micromeretics:** 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.	**10**	1.Martin's Physical Pharmacy and Pharmaceutical Sciences, 5th Edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2.Remington. The science and practice of pharmacy, 22nd edition, Philadelphia.

UNIT-V **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	**10**	1.Martin's Physical Pharmacy and Pharmaceutical Sciences, 5th Edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia. 2.Remington. The science and practice of pharmacy, 22nd edition, Philadelphia. 3.James Swarbrick. Encyclopaedia of pharmaceutical technology, 2nd edition, marcel Dekker Inc, New York. Vol.3.

BP 404T

II/IV B.PHARMACY – 4th SEMESTER

BP 404T - PHARMACOLOGY-I (THEORY) 45 Hours

Scope: The main purpose of the subject is to understand what drugs do 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, contradictions 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 Outcomes :

C404.1	To define the fundamental concepts of pharmacology and pharmacokinetics.
C404.2	To understand the basics of pharmacodynamics, adverse reactions, drug interactions and drug discovery
C404.3	To identify the role of neurohumoral transmission and drugs acting on peripheral nervous system.
C404.4	To analyze the functions of neurotransmitters and drugs acting on central nervous system.
C404.5	To appraise the pharmacology of Psychopharmacological agents.
C404.6	To predict the effects of drugs against neurodegenerative disorders and to elaborate the concepts of drug addiction/abuse/tolerance/dependence

Course Content:

Chapter/Topics	Duration	References
Unit No.I	**8 hrs**	
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 admin-istration, 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, Structural Activity Relationship.	4 hrs 4 hrs	1. Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Chapter No.: 1 – 4 2. Pharmacology – H.P Rang & M.M Dale; 6th edition; Churchill livingstone publishers; Chapter No.:3, 4.
Unit No.II	**12 hrs**	
General Pharmacology a) **Pharmacodynamics** — Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors, drug receptors interactions signal transduction mechanism, G-protein coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.	5 hrs	1. Principles of Pharmacology – David E Golan; 3rd edition; Chapter No.: 1 & 2 2. Lipincott Williams & Wilkins publishers; Chapter No.:2.

b) Adverse drug reactions c) Drug interactions (Pharmacokinetic and pharmacodynamic) d) Drug discovery and clinical evaluation of new drugs- Drug discovery phase, pre clinical evaluation phase, phases of clinical trials and pharmacovigilance.	2 hrs 2 hrs 3 hrs	
Unit No.III	**10 hrs**	
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	 1 hr 2 hrs 3 hrs 2 hrs 1 hr 1 hr	1. Principles of Pharmacology – David E Golan; 3rd edition; Chapter No.: 9 - 11 2. Lipincott Williams & Wilkins publishers; Chapter No.:3 - 7. 3. Pharmacology – H.P Rang & M.M Dale; 5th edition; Churchill livingstone publishers; Section-4; Chapter No: 43
Unit No.IV	**8 hrs**	
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	 2 hrs 2 hrs 1 hr 2 hrs 1 hr	1. Pharmacology – H.P Rang & M.M Dale; 5th edition; Churchill livingstone publishers; Chapter No.:32 - 34. 2. Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Chapter No.:31-35, 37, 39, 40.

Unit No.V	7 hrs	
Pharmacology of drugs acting on Central Nervous System a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens. b. Drugs used in Parkinson's disease and Alzheimer's disease. c. CNS stimulants and nootropics. d. Opioid analgesics and antagonists e. Drug addiction, drug abuse, tolerance and dependence.	2 hrs 2 hrs 1 hr 1 hr 1 hr	1. Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Chapter No.:31-35, 37, 39, 40. 2. Principles of Pharmacology – David E Golan; 3rd edition; Chapter No.:18.

Further References (Latest Editions)

1. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata McGraw-Hill
2. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
3. 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 LippincottWilliams &Wilkins
4. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
5. Modern Pharmacology with clinical Applications, by Charles R.Craig & Robert,

BP 405T

II/IV B.PHARMACY – 4th SEMESTER
PHARMACOGNOSY AND PHYTOCHEMISTRY-I
(Theory) 45 Hours

Scope of the subject:

— 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.

— To learn and understand the cultivation, collection and storage of crude drugs and their usefulness and to make the student aware of systematic pharmacognostic study of crude drugs.

Course Outcomes :

C405.1	To recall the history, scope and development of pharmacognosy.
C405.2	To remember different sources of crude drugs and also classify them accordingly.
C405.3	To illustrate students about cultivation, collection, processing and storage of crude drugs.
C405.4	To plan systematic pharmacognostic study of primary metabolites, ayurvedic drugs, marine drugs and teratogens.
C405.5	To analyze quality of crude drugs.
C405.6	To elaborate the applications of advanced technologies like polyploidy, mutation and hybridization in medicinal plants.

Outcome of the subject:

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

— To know the techniques in the cultivation and production of crude drugs.

— To know the crude drugs their uses and chemical nature

— To know the evaluation techniques of the herbal rugs

— Understand macroscopical and microscopical characteristics of plant drugs

Chapter/ Topics	Duration	References
Unit No.I	**10 hrs**	
1. 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).	3 hrs 2 hrs	1. Textbook of Pharmacognosy–T. E. Wallis; 5th edition ; CBS Publishers; Chapter:1 2. Text book of pharmacognosy-S.S.Handa,V.K Kapoor; Second Edition;Vallabh Prakashan Publishers; Chapter:2

2. Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and serotaxonomical classification of drugs **3. 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, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.	5 hrs	3. Quality control of herbal drugs- Dr.Pullok. K.Mukherjee; 1st edition; Business Horizons Publishers; Part I : 1 4. Pharmacognosy – C.K.Kokate; 50th edition; Nirali Prakashan Publishers; Chapter:1 5. Quality Control of Herbal Drugs- Dr.Pullok.K.Mukherjee; 1st edition Business Horizons Publishers; Part II :4 6. Trease & Evans Pharmacognosy – W.C .Evans; 15th Edition; Elsevier publishers; Part 3: 14 & Part 9: 42
Unit No.II	**10 hrs**	
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	2 hrs 4 hrs 2 hrs 2 hrs	Trease & Evans Pharmacognosy – W.C .Evans; 15th edition; Elsevier publishers; Part 3 :9,10&12
Unit No.III	**7 hrs**	
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	7 hrs	1. Plant tissue culture- S.S.Bhajwani;1st edition;Elsevier; Chapter: 3 – 16 2. Biotechnology – V.Kumaresan; 1st edition; Saras publications; Chapter-20

Unit No.IV	10 hrs	
1. 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. **2. Introduction to secondary metabolites:** Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins	5 hrs 5 hrs	1. Essentials of Pharmacognosy- Dr.S.H.Ansari, Birla publications, 1st edition, Chapter-12 2. Trease & Evans Pharmacognosy – W.C .Evans; 15th edition; Elsevier publishers; Part 5 : 19
Unit No.V	**8 hrs**	
Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs **1. Plant Products:** Fibers - Cotton, Jute, Hemp, Hallucinogens, Teratogens, Natural allergens **2. Primary metabolites:** General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following primary metabolites: – **Carbohydrates:** Acacia, Agar, Tragacanth, Honey – **Proteins and Enzymes :** Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin). – **Lipids(Waxes, fats, fixed oils)** : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax – **Marine Drugs:** Novel medicinal agents from marine sources	3 hrs 5 hrs	1. Trease & Evans Pharmacognosy – W.C Evans; Fifteenth Edition ; Elsevier publishers; Part 6 :21-23. 2. Textbook of Pharmacognosy –T. E. Wallis; 5th edition ; CBS Publishers;

Further References:

1. American Herbal Pharmacopoeia-Roy Upton; 1 st Edition;CRS Press publishers.
2. Hand Book of Medicinal Herbs-James A. Duke; 2nd edition;CRS Press publishers.
3. Plant Drug Analysis-H.Wagner; 2nd edition; Springer publishers.

BP 406 P

II/IV B.PHARMACY – 4th SEMESTER
BP406P-MEDICINAL CHEMISTRY – I
(PRACTICAL) 60 Hours

Course Outcomes :

C406.1	To recall the basic requirements for synthesis and assay of drugs
C406.2	To explain the techniques involved in isolation and purification of drugs and intermediates
C406.3	To synthesize, characterize and purify medicinal compounds and intermediates
C406.4	To analyze the selected drugs present in dosage forms and to determine the percentage purity
C406.5	To determine the physicochemical property of drugs and draw its importance

Course Content:

S. No.	Name of the Experiment	Durat-ion (hrs)	References
I Preparation of drugs/ intermediates			
1	1,3-pyrazole	**4**	1.Bently and Driver's, text book of Pharmaceutical Chemistry, 8th edition, L.M.Atherdem, 2004, Pg.No.614 2.Experimental organic and medicinal chemistry by Biren N.Shah, S.Vikas and Co, 2016, Pg.No.149.
2	1,3-oxazole :	**4**	1.Bently and Driver's, text book of Pharmaceutical Chemistry, 8th edition, L.M.Atherdem, 2004, Pg.No.699 2.Experimental organic and medicinal chemistry by Biren N.Shah, S.Vikas and Co, 2016, Pg.No.167.
3	Benzimidazole :	**4**	1.Bently and Driver's, text book of Pharmaceutical Chemistry, 8th edition, L.M.Atherdem, 2004, Pg.No.651 2.Experimental organic and medicinal chemistry by Biren N.Shah, S.Vikas and Co, 2016, Pg.No.144.
4	Benztriazole :	**4**	Experimental organic and medicinal chemistry by Biren N.Shah, S.Vikas and Co, 2016, Pg.No.150.
5	2,3- diphenyl quinoxaline	**4**	Experimental organic and medicinal chemistry by Biren N.Shah, S.Vikas and Co, 2016, Pg.No.165.

6	Benzocaine	**4**	Bently and Driver's, text book of Pharmaceutical Chemistry, 8th edition, L.M.Atherdem, 2004, Pg.No.681, 686
7	Phenytoin	**4**	Experimental organic and medicinal chemistry by Biren N.Shah, S.Vikas and Co, 2016, Pg.No.160.
8	Phenothiazine	**4**	Bently and Driver's, text book of Pharmaceutical Chemistry, 8th edition, L.M.Atherdem, 2004, Pg.No.672
9	Barbiturate	**4**	1.Bently and Driver's, text book of Pharmaceutical Chemistry, 8th edition, L.M.Atherdem, 2004, Pg.No.664 2.Experimental organic and medicinal chemistry by Biren N.Shah, S.Vikas and Co, 2016, Pg.No.151.
II Assay of drugs			
1	Chlorpromazine	**3**	Indian Pharmacopia, 2018, Vol.II, Pg.No.1599 -1601
2	Phenobarbitone	**3**	Indian Pharmacopia, 2018, Vol.II, Pg.No.2899 -2902
3	Atropine	**3**	Indian Pharmacopia, 2018, Vol.II, Pg.No.1296-1300
4	Ibuprofen	**3**	Indian Pharmacopia, 2018, Vol.II, Pg.No.2261-2265
5	Aspirin	**3**	Indian Pharmacopia, 2018, Vol.II, Pg.No.1277
6	Furosemide	**3**	Indian Pharmacopia, 2018, Vol.II, Pg.No.2133 -2135
III	**Determination of Partition coefficient for any two drugs**	**6**	Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and Wilkins, 2004

Recommended Books (Latest Editions)

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

BP 407 P

II/IV B.PHARMACY – 4th SEMESTER
BP407P-PHYSICAL PHARMACEUTICS- II
(PRACTICAL) 60 Hours

Course Outcomes :

C407.1	To choose a good suspending agent to formulate a stable suspension.
C407.2	To interpret the shelf life of a given formulation by accelerated stability studies.
C407.3	To make use of derived and flow properties of powders to ensure a stable solid formulation.
C407.4	To distinguish the rate constants as per the chemical reaction.
C407.5	To determine the viscosity using Ostwald's and Brookfield's viscometer.
C407.6	To predict the flux by Franz diffusion cell.

Course Content:

S. No.	Chapter / Topic	Duration (Hrs.)	References
1	Determination of particle size, particle size distribution using sieving method	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
2	Determination of particle size, particle size distribution using Microscopic method	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
3	Determination of bulk density, true density and porosity	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
4	Determine the angle of repose and influence of lubricant on angle of repose	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
5	Determination of viscosity of liquid using Ostwald's viscometer.	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
6	Determination sedimentation volume with effect of different suspending agent	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
7	Determination sedimentation volume with effect of different concentration of single suspending agent	4	Laboratory Manual of Physical Pharmaceutics, C.V.S.Subramanyam, J.Thimma Settee

8	Determination of viscosity of semisolid by using Brookfield viscometer	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
9	Determination of reaction rate constant first order.	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
10	Determination of reaction rate constant second order.	4	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
11	Accelerated stability studies	8	Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J.Thimma Settee
12	Determination of flux by Franz diffusion cell	8	Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia.
13	Determination of reaction rate constant for pseudo first order reaction	4	Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth edition, Patrick J.Sinko, Lippincott Williams & Wilkins, Philadelphia.

BP 408 P

II/IV B.PHARMACY – 4th SEMESTER
BP408 P - PHARMACOLOGY-I
(PRACTICAL) 60 Hours

Course Outcomes :

C408.1	To learn about basic instruments, common laboratory animals used in experimental pharmacology and to organize animal house as per the CPCSEA guidelines.
C408.2	To demonstrate the common laboratory techniques like routes of administration , blood withdrawal, anesthetics and euthanasia used for animal studies
C408.3	To interpret the effects of various drugs on rabbit eye and ciliary motility of frog oesophagus in correlation with humans
C408.4	To analyse the effect of drugs acting as enzyme inducers, skeletal muscle relaxants and affecting locomotor activity in laboratory animals
C408.5	To evaluate the stereotype and anticatatonic activity of drugs in rats/mice
C408.6	To predict various screening models for anticonvulsant and anxiolytic activity

Course Content:

Expt. No.	Name of the Experiment	Duration	References
1	Introduction to experimental pharmacology	3 hrs	Hand book of Experimental Pharmacology – S.K.Kulkarni; 3rd edition; Vallabh Prakashan publishers; Exp. No.:1
2	Commonly used instruments in experimental pharmacology	6 hrs	Hand book of Experimental Pharmacology – S.K.Kulkarni; 3rd edition; Vallabh Prakashan publishers; Exp. No.:1
3	Study of common laboratory animals	6 hrs	Screening methods in Pharmacology - N.S. Parmar; 1st edition; Narosa publishers; Exp. No.:3.
4	Maintenance of laboratory animals as per CPCSEA guidelines	3 hrs	Hand book of Experimental Pharmacology – S.K.Kulkarni; 3rd edition; Vallabh Prakashan publishers; Exp. No.:2.
5	Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.	6 hrs	Drug discovery and evaluation, pharmacological assays; H. Gerhard Vogel; 2nd edition; Chapter Q.

6	Study of different routes of drugs administration in mice/rats.	3 hrs	Introduction to experimental pharmacology, Dr. Uma Bandari; 1st edition; Birla Publications; Chapter No: 6.
7	Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.	3 hrs	Experiments in Pharmacology using animal simulator software
8	Effect of drugs on ciliary motility of frog oesophagus	3 hrs	Simulated experiments in Pharmacology using Ex-pharm probeta software
9	Effect of drugs on rabbit eye.	3 hrs	Experiments in Pharmacology using animal simulator software
10	Effects of skeletal muscle relaxants using rota-rod apparatus.	3 hrs	
11	Effect of drugs on locomotor activity using actophotometer.	3 hrs	
12	Anticonvulsant effect of drugs by MES and PTZ method.	6 hrs	Experiments in Pharmacology using animal simulator software
13	Study of stereotype and anti-catatonic activity of drugs on rats/mice	3 hrs	
14	Study of anxiolytic activity of drugs using rats/mice.	6 hrs	
15	Study of local anesthetics by different methods	3 hrs	

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

Further References:

1. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.

BP 409 P

II/IV B.PHARMACY – 4th SEMESTER
BP409P-PHARMACOGNOSY AND PHYTOCHEMISTRY-I
(PRACTICALS) 60 Hours

Course Outcomes :

C409.1	To remember different morphological and microscopical characteristic features of crude drugs.
C409.2	To understand the cellular structure of crude drugs.
C409.3	To evaluate the crude drugs by quantitative evaluation methods.
C409.4	To evaluate the crude drugs by physical methods of evaluation.
C409.5	To evaluate the crude drugs by chemical methods of evaluation.

Course Content:

S.No	Experiment	Duration	References
1	Analysis of crude drugs by chemical tests: (i) Tragaccanth (ii) Acacia (iii) Agar (iv) Gelatin (v) Starch (vi) Honey (vii) Castor oil	12 hrs	Practical pharmacognosy-Rasheeduz zafar; First edition; CBS publishers & distributors; Chapter:21 & 2
2	Determination of stomatal number and index	9 hrs	Practical pharmacognosy-DrC.K.Kokate;5thedition; Vallabhprakashan publishers; Chapter: 8 & 9
3	Determination of vein islet number, vein islet termination and paliside ratio	6 hrs	
4	Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer	6 hrs	Practical pharmacognosy-Dr C.K.Kokate; 5thedition;Vallabh prakashan publishers; Chapter: 7
5	Determination of Fiber length and width	6 hrs	
6	Determination of number of starch grains by Lycopodium spore method	6 hrs	Practical pharmacognosy-Dr C.K.kokate;5thedition; Vallabh prakashan publishers; Chapter: 9
7	Determination of Ash value	6 hrs	Quality control of herbal drugs-Dr.Pullok. K.Mukherjee; 1stedition; business horizons publishers; Part II : 9.12
8	Determination of Extractive values of crude drugs	3 hrs	Quality control of herbal drugs-Dr.Pullok. K.Mukherjee; 1st edition; Business horizons publishers; Part II : 9.2

9	Determination of moisture content of crude drugs	3 hrs	Practical pharmacognosy-Khandelwal K.R;19 th edition; Vallabh prakashan publishers; Chapter:41
10	Determination of swelling index and foaming	3 hrs	Practical pharmacognosy-Dr C.K.Kokate; 5thedition; Vallabhprakashan publishers; Chapter: 9

Further References:

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

III B.PHARMACY
5th SEMESTER

BP 501 T

BP501T - MEDICINAL CHEMISTRY – II
(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 of different class of drugs
4. Study the chemical synthesis of selected drugs

Course Outcomes :

C501.1	To recall the classification of drugs obtained by natural and synthetic route
C501.2	To explain the biological targets for medicinal compounds
C501.3	To apply the knowledge of biochemical processes to understand the mechanism of action and therapeutic uses of drugs
C501.4	To understand the relationships between structure of compound and its activity
C501.5	To choose the synthetic route for selected category of drugs
C501.6	To discuss the significance, advantages and limitations of 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 superscripted by (#) as specified in the course and synthesis of drugs superscripted by (*)

Chapter / Topic	Duration (hrs)	References
UNIT-I **Antihistaminic agents:** Histamine, receptors and their distribution in the humanbody **H1–antagonists:** Diphenhydramine# hydrochloride*, Dimenhydrinate, Doxylamine succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate#, Triprolidine hydrochloride*, Phenindamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine#, Levocetirizine and Cromolyn sodium. **H_2-antagonists:** Cimetidine*, Famotidine and Ranitidine. **Gastric Proton pump inhibitors#:** Omeprazole, lansoprazole, esomeprazole, rabeprazole and pantoprazole **Anti-neoplastic agents:** **Alkylating agents#:** Mechlorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan and Thiotepa.	**10**	1. Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry, John H.Block, John M.Beale, 11th edition, Lippincott Williams and Wilkins, 2004, Chapter 21, P.No 696. 2. Principles of organic medicinal chemistry by Rama Rao Nadendla , 1st edition, New Age International (P) Limited, Chapter 14, P.No 184. 3. Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, 6th edition, Wolter Kluwer Health (India) Pvt.Ltd, Lippincott Williams and Wilkins, Chapter 37, P.No 1004. 4. An introduction to Medicinal Chemistry, Graham L Patrick, 3rd edition, Oxford University Press, Chapter 18, P.No 489. 5. Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry, John H.Block, John M.Beale, 11th edition, Lippincott Williams and Wilkins, 2004, Chapter 12, P.No 390.

Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate* and Azathioprine **Antibiotics:** Dactinomycin, Daunorubicin, Doxorubicin and Bleomycin **Plant products:** Etoposide, Vinblastin sulphate, Vincristin sulphate and Taxol **Miscellaneous:** Cisplatin and Mitotane.		6. Medicinal chemistry by Rama Rao Nadendla 2nd edition, Pharma Med Press, 2013, Chapter 22, P.No 227 7. Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, 6th edition, Wolter Kluwer Health (India) Pvt.Ltd, Lippincott Williams and Wilkins, Chapter 42, P.No 1147.
UNIT – II **Anti-anginal agents :** Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, dipyridamole, verapamil, diltiazem and bepridil hydrochloride. **Diuretics:** **Carbonic anhydrase inhibitors#:** Acetazolamide*, Methazolamide and Dichlorphenamide. **Thiazides#:** Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide and Cyclothiazide. **Loop diuretics:** Furosemide*, Bumetanide and Ethacrynic acid. **Potassium sparing Diuretics:** Spironolactone, Triamterene and Amiloride. **Osmotic Diuretics:** Mannitol **Anti-hypertensive Agents**: **Beta blockers:** Timolol, **ACE inhibitors:** Captopril, Lisinopril, Enalapril, Benazepril hydrochloride and Quinapril hydrochloride. **Calcium channel blockers#:** Nifedipine, Amlodipine, Felodipine, Nicardipine and Nimodipine. **Vasodilators:** Hydralazine hydrochloride, Sodium nitroprusside, Diazoxide and Minoxidil	**10**	1. Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry, John H.Block, John M.Beale, 11th edition, Lippincott Williams and Wilkins, 2004, Chapter 19, P.No 622. 2. Medicinal chemistry by Rama Rao Nadendla 2nd edition, Pharma Med Press, 2013, Chapter 24, P.No 300 3. Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, 6th edition, Wolter Kluwer Health (India) Pvt.Ltd, Lippincott Williams and Wilkins, Chapter 26, P.No 698.

Miscellaneous: Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate and Reserpine.		
UNIT- III **Anti-arrhythmic Drugs**: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone and Sotalol. **Anti-hyperlipidemic agents**: **Fibrates:** Clofibrate **Statins:** Lovastatin **Miscellaneous:** Cholesteramine and Cholestipol **Coagulant & Anticoagulants**: Menadione, Acetomenadione, Warfarin*, Anisindione and clopidogrel **Drugs used in Congestive Heart Failure:** Digoxin, Digitoxin, Nesiritide, Bosentan and Tezosentan.	**10**	1.Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, 6th edition, Wolter Kluwer Health (India) Pvt.Ltd, Lippincott Williams and Wilkins, Chapter 26, P.No 698. 2.Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry, John H.Block, John M.Beale, 11th edition, Lippincott Williams and Wilkins, 2004, Chapter 19, P.No 634. 3.Medicinal chemistry by Rama Rao Nadendla 2nd edition, Pharma Med Press, 2013, Chapter 24, P.No 284
UNIT- IV **Drugs acting on endocrine system** Nomenclature, stereochemistry and metabolism of steroids **Sex hormones**: Testosterone, Nandralone, Progesterone, Oestriol, Oestradiol, Oestrione and Diethyl stilbestrol. **Drugs for erectile dysfunction:** Sildenafil and Tadalafil. **Oral contraceptives:** Mifepristone, Norgestrel and Levonorgestrol. **Corticosteroids:** Cortisone, Hydrocortisone, Prednisolone, Betamethasone and Dexamethasone	**08**	1. Medicinal chemistry by Rama Rao Nadendla 2nd edition, Pharma Med Press, 2013, Chapter 28, P.No 349. 2. Principles of Medicinal Chemistry S.S Kadam, Nirali Prakashan, Vol-II, Chapter 17, P. No 17.1. 3. Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, 6th edition, Wolter Kluwer Health (India) Pvt.Ltd, Lippincott Williams and Wilkins, Chapter

Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil and Methimazole.		33 & 34, P.No 877 & 913 4. Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry, John H.Block, John M.Beale, 11th edition, Lippincott Williams and Wilkins, 2004, Chapter 23, P.No 767
UNIT – V **Antidiabetic agents:** Insulin and its preparations **Sulfonyl ureas#:** Tolbutamide*, Chlorpropamide, Glipizide, Glibenclamide and Glimepiride. **Biguanides#:** Metformin. **Thiazolidinediones:** Pioglitazone, Rosiglitazone. **Meglitinides:** Repaglinide, Nateglinide. **Glucosidase inhibitors:** Acrabose and Voglibose. **DPP-4 inhibitors:** Vildagliptin and Linagliptin **Local Anesthetics:** SAR of Local anesthetics **Benzoic acid derivatives#:** Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine and Piperocaine. **Amino Benzoic acid derivatives**: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine and Benoxinate. **Anilide derivatives#**: Lignocaine, Mepivacaine, Prilocaine and Etidocaine. **Miscellaneous**: Phenacaine, Diperodon and Dibucaine.*	**07**	1. Principles of Medicinal Chemistry S.S Kadam, Nirali Prakashan, Vol-I,Chapter 12,P.No 191. 2. Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, 6th edition, Wolter Kluwer Health (India) Pvt.Ltd, Lippincott Williams and Wilkins, Chapter 32, P.No 855 3. Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry, John H.Block, John M.Beale, 11th edition, Lippincott Williams and Wilkins, 2004, Chapter 19, P.No 668. 4. Principles of organic medicinal chemistry by Rama Rao Nadendla , 1st edition, New Age International (P) Limited, Chapter 21, P.No 270 5. Wilson and Gisvold text book of organic medicinal and pharmaceutical chemistry, John H.Block, John

		M.Beale, 11th edition, Lippincott Williams and Wilkins, 2004, Chapter 20, P.No 676. 6. Principles of organic medicinal chemistry by Rama Rao Nadendla , 1st edition, New Age International (P) Limited, Chapter 19, P.No 249. 7. Foye's Principle s of Medicnal Chemistry, David A.Williams, Thomas L.Lenke, 6th edition, Wolter Kluwer Health (India) Pvt.Ltd, Lippincott Williams and Wilkins, Chapter 16, P.No 462

Recommended Books (Latest Editions)

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

BP 502 T

BP502T - INDUSTRIAL PHARMACY-I

(Theory) 45 Hours

Scope: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

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

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and parenteral dosage forms and evaluate them for their quality.

Course Outcomes :

C502.1	To outline the objectives and applications of preformulation studies in the development and stability of dosage forms.
C502.2	To discuss the formulation, manufacturing, coating and quality control tests of tablets.
C502.3	To review the formulation and manufacturing considerations of liquid orals.
C502.4	To illustrate the pharmaceutical aspects of capsules and pellets.
C502.5	To describe the preparation and quality control of parenterals and ophthalmic preparations.
C502.6	To summarize formulation, manufacturing and evaluation of cosmetic preparations, pharmaceutical aerosols and appraise the science of packaging materials.

Course content:

Chapter / Topic	Duration (hrs)	References
UNIT-I **Preformulation Studies:** Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances. ***a. Physical properties:*** Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism	**07**	1. G.S.Banker Modern Pharmaceutics, 4th Edition, Ch-7, P.No.167, Informa healthcare USA, 2009. 2. M.E.Aulton, Pharma-ceutics, The Design and Manufacture of Medicine, Part-5, 3rd Edition, Pg.No.336, Elsevier Ltd., 2007.

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significane. Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.		3. Lachman.L, Lieberman H.A., Joseph, LK. The Theory and practice of industrial pharmacy, 4th Edition, Ch.9, pg.No.217, CBS Publishers and distributors, 2013.
UNIT-II **Tablets:** a.Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipment and tablet tooling. b.Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. c.Quality control tests: In process and finished product tests **Liquid orals:** Formulation and manufacturing considerations of syrups and elixirs; suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia. Formulation of dry syrups.	**10**	01.Lachmann.L, Liebermann H.A., Joseph L.K. The theory and practice of industrial pharmacy, 4th edition, Ch-13, 17, CBS Publishers, Pg.No.449, 629, 2013, 2.G.S.Banker, Modern Pharmaceutics, 4th edition, Ch-10, Pg.No. 287, Informa Health Care, USA, 2009 3. Loyd.V.Allen, Jr.Howard. C.Ansel, Pharmaceutical Dosageforms and drug delivery systems. Ch.13, 14. Wolters Kluwer, 2011. 4. Aulton M.E.,Pharma-ceutics. The Science of dosage form design, Ch.24, 26, 27, 4th edition, Pg.No.395, 416, 435, churchili Livingston, 2013
UNIT-III **Capsules:** a.***Hard gelatin capsules:*** Introduction, Production of hard gelatin capsule shells. Size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules.	**08**	1. G.S.Banker, Modern Pharmaceutics, 4th edition, ch-11, Pg.No.335, Informa Health Care, USA, 2009. 2. Lachmann.L, Liebermann H.A., Joseph L.K. The Theory and Practice of Industrial Pharmacy, 4th Edition, Ch.-14, P.No.546, CBS Publishers, 2013.

b.***Soft gelatin capsules:*** Nature of shell and capsule content, size of capsules,importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications. **Pellets:** Introduction, formulation requirements, pelletization process, equipment for manufacture of pellets		3. Issac Ghebre-Sellassie, Pharmaceutical Pelletization Technology, Ch-6, 10, 11, Pg.No.145, 217, 241. Informa Health Care, USA, 2010.
UNIT-IV **Parenteral Products:** a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity b. Production procedure, production facilities and controls, aseptic processing c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products. d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products. **Ophthalmic Preparations:** Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labelling, containers; evaluation of ophthalmic preparations	**10**	1. G.S.Banker, Modern Pharmaceutics, 4th edition, ch-12, 13, Pg.No.381, 415, Informa Health Care USA, 2009. 2. Lachmann.L, Liebermann H.A.Joseph UK. The theory and practice of Industrial Pharmacy, 4th edition, Ch-23, Pg.No.828, CBS Publishers, 2013. 3. Loyd V.Allen Jr.Howard. C.Ansel, Pharmaceutical Dosage forms and Drug Delivery systems. Ch-15, Pg.No.l431, Wolters kluwer, 2011. 4. Aulton M.E., Design and Manufacture of Medicines, Ch.No.41, Pg.No.710, Churchill Livingstone, 2013.
UNIT-V **Cosmetics:** Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.	**10**	01.Sanjunanda, Cosmetic Technology, Ch.-12, 15, 16, 17, 20, Biral Publications, 2007.

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. **Packaging Materials Science:** Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.		2. G.S.Banker, Modern Pharmaceutics, 4th edition, ch-17, Informa Health Care USA, 2009. 1. Lachmann.L, Liebermann H.A.Joseph UK. The theory and practice of Industrial Pharmacy, 4th edition, Ch-21, 27, CBS Publishers, 2013.

BP 503 T

BP503T - PHARMACOLOGY-I

(Theory) 45 Hours

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in adition, emphasis on the basic concepts of bioassay.

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

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Course Outcomes :

C503.1	To relate the relative pros and cons in the use of drugs for various cardiac complications.
C503.2	To illustrate the drugs acting on hematopoietic system, shock diuretics and anti-diuretics.
C503.3	To identify the role of autocoids and related drugs.
C503.4	To analyze and summarize the drugs acting on endocrine system.
C503.5	To appraise the physiological role of sex hormones and to assess the effects of oral contraceptives and drugs acting on the uterus.
C503.6	To predict principles of bioassay and to construct the bioassay methods of various compounds.

Course Content:

Chapter/Topic	Duration (hrs)	References
UNIT-I **Pharmacology of drugs acting on cardio vascular system** a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs.	**10 hrs** 1 hr 2 hrs 2 hrs	1)Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-4, Chapter No. : 19-23.

d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidemic drugs.	1 hr 2 hrs 2 hrs	2)Pharmacology – H.P Rang & M.M Dale; 6th edition; Churchill livingstone publishers; Section-3, Chapter No.:18 – 22. 3)Essentials of Medical Pharmacology - K.D. Tripathi; Jaypee publications; Section-10, Chapter No.: 45.
UNIT-II **1. Pharmacology of drugs acting on cardio vascular system** a. Drug used in the therapy of shock. b.Hematinics, coagulants and anticoagulants. c.Fibrinolytics and anti-platelet drugs d. Plasma volume expanders **2. Pharmacology of drugs acting on urinary system** a. Diuretics b. Anti-diuretics.	**10 hrs** **6 hrs** 1 hr 3 hr 1 hr 1 hr **4 hrs** 3 hrs 1 hr	1)Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-10, Chapter No. : 50, 51. 2) Essentials of Medical Pharmacology - K.D. Tripathi; Jaypee publications; Section-9, Chapter No.: 41-42, Section-10, Chapter No.: 43-45.
UNIT-III **Autocoids and related drugs** a. Introduction to autacoids and classification b. Histamine, 5-HT and their anta-gonists. c. Prostaglandins, Thromboxanes and Leukotrienes. d. Angiotensin, Bradykinin and Substance P. e. Non-steroidal anti-inflammatory agents f. Anti-gout drugs g. Antirheumatic drugs	**10 hrs** 1 hr 2 hrs 2 hrs 1 hr 2 hrs 1 hr 1 hr	1. Essentials of Medical Pharmacology - K.D. Tripathi; Jaypee publications; Section-3, Chapter No.: 11. 2. Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-5, Chapter No. 24 -26.
UNIT-IV **Pharmacology of drugs acting on endocrine system** a.Basic concepts in endocrine pharmacology. b.Anterior Pituitary hormones-analogues and their inhibitors.	**08 hrs** 1 hr 1 hr	1.Essentials of Medical Pharmacology - K.D. Tripathi; Jaypee publications; Section-5, Chapter No.: 17-20, 24. 2.Principles of

c. Thyroid hormones- analogues and their inhibitors. d.Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D. e. Insulin, Oral Hypoglycemic agents and glucagon. f. ACTH and corticosteroids.	2 hrs 1hr 2 hrs 1 hr	Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-8, Chapter No: 41-42,45-47.
UNIT-V **1.Pharmacology of drugs acting on endocrine system** a.Androgens and Anabolic steroids. b.Estrogens, progesterone and oral contraceptives. c.Drugs acting on the uterus. **2.Bioassay** a.Principles and applications of bioassay. b.Types of bioassay c.Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT	**07 hrs** **4 hrs** 1 hr 2 hrs 1 hr **3 hrs** 1 hr	1.Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-8, Chapter No.: 43- 44. 2.Essentials of Medical Pharmacology - K.D. Tripathi; Jaypee publications; Section-5, Chapter No.: 21-23. 3.Hand book of Experimental Pharmacology – S.K.Kulkarni 3rd edition; Vallabh Prakashan publishers; Exp No: 1. 4.Indian Pharmacoepiea (1985); Indian Pharmacoepiea Commission; Vol-1 & 2

BP 504 T

BP504T - PHARMACOGNOSY AND PHYTOCHEMISTRY II

(Theory) 45 Hours

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

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

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

Course Outcomes :

C504.1	To outline the metabolic pathway in higher plants and their biogenetic studies.
C504.2	To the pharmacognistic study of secondary metabolites like alkaloids, glycosides, tannins, volatile oils etc,
C504.3	To demonstrate the different types and steps involved in isolation, identification and analysis of Phytoconstituents like terpenoids, glycosides, alkaloids and resins.
C504.4	To plan the industrial production, estimation and utilization of Phytoconstituents.
C504.5	To assess the crude drug by modern methods of extraction, spectroscopy, chromatography, isolation and purification.

Course Content:

Chapter / Topic	Duration (hrs)	References
UNIT-I **Metabolic pathways in higher plants and their determination** a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway. b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.	**07 hrs** 05 hrs 02 hrs	1)Trease & Evans Pharmacognosy – W.C. Evans; 15th Edition; Elsevier publishers; Part 5 :19 2)Pharmacognosy & Phytochemistry – Vinod.D.Rangari; Career publications;Part 1 :9

UNIT-II General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites: **Alkaloids:** Vinca, Rauwolfia, Belladonna, Opium. **Phenylpropanoids and Flavonoids:** Lignans, Tea, Ruta **Steroids, Cardiac Glycosides & Triterpenoids**: Liquorice, Dioscorea, Digitalis **Volatile oils**: Mentha, Clove, Cinnamon, Fennel, Coriander, **Tannins:** Catechu, Pterocarpus **Resins:** Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony **Glycosides:** Senna, Aloes, Bitter Almond **Iridoids, Other terpenoids & Naphthaquinones:** Gentian, Artemisia, taxus, carotenoids	**14 hrs** 03 hrs 01 hr 03 hrs 02 hrs 01 hr 01 hr 01 hr 01 hr 01 hr	1)Pharmacognosy - C.K. Kokate;50th edition;Nirali Prakashan Publishers; Chapter:1 2)Trease & Evans Pharmacognosy – W.C. Evans; 15th Edition; Elsevier publishers; Part 6 :20 - 34
UNIT-III Isolation, Identification and Analysis of Phytoconstituents **a)Terpenoids:** Menthol, Citral, Artemisin **b)Glycosides:** Glycyrhetinic acid & Rutin **c)Alkaloids:** Atropine, Quinine, Reserpine, Caffeine **d) Resins:** Podophyllotoxin, Curcumin	**06 hrs** 02 hrs 02 hrs 02 hrs	1. Standardization of Botanicals – Dr.V.Rajpal; Volume1-3. 2. Indian Herbal Pharmacopoeia;2002.
UNIT-IV **1.Industrial production, estimation and utilization of the following phytoconstituents:** Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine 2.Commericilization and Industrialization of Medicinal plants	**10 hrs** 8 hrs 2 hrs	1. Standardization of Botanicals – Dr.V.Rajpal; Volume1-3. 2. Text book of industrial pharmacogonsy by AN Kalia, Chapter-4, 5
UNIT-V **Basics of Phytochemistry** Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.	**08 hrs**	1. Phytochemical methods, J.B.Harborne; 3rd edition;Unit 1

BP 505 T

BP505T-PHARMACEUTICAL JURISPRUDENCE

(Theory) 45 Hours

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

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

1. The pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
2. Various Indian pharmaceutical acts and laws
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. The code of ethics during the pharmaceutical practice

Course Outcomes :

C505.1	To recall the pharmaceutical legislations, ethics, right to information, medical termination of pregnancy and intellectual property rights
C505.2	To relate the significance of Drugs and cosmetics act 1940 and its rules 1945 in relation to import and manufacture of drugs
C505.3	To apply the knowledge on schedules pertaining to Drugs and cosmetics act 1940 and its rules 1945 and also administration of the act and rules
C505.4	To understand the functions of pharmacy councils and implementation of education regulations in pharmacy
C505.5	To appraise the importance of medicinal and toilet preparations act and narcotic drugs and psychotropic substances act and rules
C505.6	To discuss the salient features of drugs and magic remedies act, prevention of cruelty to animals act and drugs price control order

Course Content:

Chapter/Topic	Duration (hrs)	References
UNIT-I **Drugs and Cosmetics Act, 1940 and its rules 1945:** Objectives, definitions, legal definitions of schedules to the act and rules. Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.** Manufacture of drugs – Prohibition of manufacture and sale of certain	**10**	1. A textbook of forensic pharmacy, N.K. Jain, 8th edition, vallabh prakashan, 2015, chapter-5, pg.no.49. 2. Textbook of forensic pharmacy, B.M. Mithal, 10th edition, vallabh prakashan, 2004, chapter-6, pg. no.73.

drugs, conditions for grant of license and conditions of license for manufacture of drugs, manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.		
UNIT-II **Drugs and Cosmetics Act, 1940 and its rules 1945.** Detailed study of Schedule G, H, L, M, N, P, T, U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, retail sale and restricted license, offences and penalties. Labeling & packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, list of permitted colors. Offences and penalties. Administration of the act and rules – Drugs Technical Advisory Board, Central Drugs Laboratory, Drugs Consultative Committee, Government analyst, Licensing authorities, controlling authorities and Drug Inspector.	**10**	1. A textbook of forensic pharmacy, N.K. Jain, 8th edition, vallabh prakashan, 2015, chapter-5, pg.no.120. 2. Textbook of forensic pharmacy, B.M. Mithal, 10th edition, vallabh prakashan, 2004, chapter-6, pg. no.97.
UNIT-III • **Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education regulations, State and Joint state pharmacy councils; constitution and functions, Registration of pharmacists, offences and penalties • **Medicinal and Toilet Preparation Act –1955**: Objectives, definitions, licensing, manufacture In bond and outside bond, export of alcoholic preparations, manufacture of ayurvedic, homeopathic, Patent & Proprietary preparations. Offences and penalties.	**10**	1. Textbook of forensic pharmacy, B.M. Mithal, 10th edition, vallabh prakashan, 2004, chapter-3, 4 & 5, pg. no.16, 31 & 48. 2. A textbook of forensic pharmacy, N.K. Jain, 8th edition, vallabh prakashan, 2015, chapter-3, 7 & 6, pg.no.20, 246 & 197. 3. Textbook of forensic pharmacy, C.K. Kokate, Pharma book syndicate, 2006, chapter-4, pg.no.19.

• **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, definitions, authorities and officers, constitution and functions of Narcotic & Psychotropic substances Consultative Committee, National Fund for Controlling the Drug Abuse, prohibition, control and regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and penalties		
UNIT-IV • **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, definitions, prohibition of certain advertisements, classes of exempted advertisements, offences and penalties • **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for breeding and stocking of animals, performance of experiments, transfer and acquisition of animals for experiment, records, power to suspend or revoke registration, offences and penalties • **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)- 2013. Objectives, definitions, sale prices of bulk drugs, retail price of formulations, retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM).	**08**	1. A textbook of forensic pharmacy, N.K. Jain, 8th edition, vallabh prakashan, 2015, chapter-8, 14, 9 & 10, pg.no.271, 336, 281 & 304. 2. Textbook of forensic pharmacy, B.M. Mithal, 10th edition, vallabh prakashan, 2004, chapter-10, pg. no.160. 3. Textbook of forensic pharmacy, C.K. Kokate, Pharma book syndicate, 2006, chapter-7, pg.no.42.

UNIT-V • **Pharmaceutical Legislations –** A brief review, Introduction, study of drugs enquiry committee, Health survey and Development Committee, Hathi committee and Mudaliar committee • **Code of Pharmaceutical ethics** Definition, pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath • **Medical Termination of Pregnancy Act** • **Right to Information Act** • **Introduction to Intellectual Property Rights (IPR)**	**07**	1. A textbook of forensic pharmacy, N.K. Jain, 8th edition, vallabh prakashan, 2015, chapter-2, 29, 12, 28 & 15, pg.no.11, 484, 318, 476 & 343. 2. Textbook of forensic pharmacy, C.K. Kokate, Pharma book syndicate, 2006, chapter-3 & 16, pg.no.15 & 176. 3. Textbook of forensic pharmacy, B.M. Mithal, 10th edition, vallabh prakashan, 2004, chapter-12 & 14, pg. no.169 & 177.

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh
2. Hand book of drug law-by M.L. Mehra
3. Drugs and Cosmetics Act/Rules by Govt. of India publications.
4. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
5. Narcotic drugs and psychotropic substances act by Govt. of India publications
6. Drugs and Magic Remedies act by Govt. of India publication
7. Bare Acts of the said laws published by Government. Reference books (Theory)

BP 506 P

BP506P - INDUSTRIAL PHARMACY-I
(Practical) 60 Hours

Course Outcomes :

C506.1	To interpret the preformulation studies on drugs.
C506.2	To explain the preparation, evaluation and coating of tablets.
C506.3	To illustrate the formulation and evaluation of capsules.
C506.4	To design parenteral and ophthalmic products.
C506.5	To describe the preparation of creams.
C506.6	To evaluate glass containers as per pharmacopeial specifications.

Course Content:

S. No.	Name of the Experiment	Duration (Hrs)	References
1	Preformulation studies on paracetamol/aspirin/ or any other drug	4	Roop.K.Khar, S.P.Vyas. Lachman/Liberman's the theory and practice of industrial pharmacy, Ch.9, Pg.217, 4th edition, 2013, CBS publishers, New Delhi,
2	Formulation and evaluation of paracetamol tablets by wet-granulation technique.	4	C.V.S.Subrahmanyam, J.Thimmasetty, laboratory manual of industrial pharmacy, Pg.12, 1st Edition, 2006, Vallabha publications, New Delhi.
3	Formulation and evaluation of aspirin tablets by dry granulation technique.	4	C.V.S.Subrahmanyam, J.Thimmasetty, laboratory manual of industrial pharmacy, Pg.25,1st Edition, 2006, Vallabha publications, New Delhi.
4	Coating of tablets- film coating of tablets/ granules.	4	Roop.K.Khar, S.P.Vyas. Lachman/Liberman's the theory and practice of industrial pharmacy, Ch.13, Pg.518, 4th edition, 2013, CBS publishers, New Delhi,
5	Preparation and evaluation of tetracycline HCl capsules.	4	Dr.A.K.Seth, Practical Pharmaceutics, Pg.230,
6	Preparation of Calcium gluconate injection.	4	C.V.S.Subrahmanyam, J.Thimmasetty, laboratory manual of industrial pharmacy, Pg.85, 1st Edition, 2006, Vallabha publications, New Delhi.

7	Preparation of ascorbic acid injection.	4	C.V.S.Subrahmanyam, J.Thimmasetty, laboratory manual of industrial pharmacy, Pg.78, 1st Edition, 2006, Vallabha publications, New Delhi.
8	Quality control tests of (as per IP) marketed tablets.	4	C.V.S.Subrahmanyam, J.Thimmasetty, laboratory manual of industrial pharmacy, Pg.46, 1st Edition, 2006, Vallabha publications, New Delhi.
9	Quality control test of (as per IP) marketed capsules	4	C.V.S.Subrahmanyam, J.Thimmasetty, laboratory manual of industrial pharmacy, Pg.61,1st Edition, 2006, Vallabha publications, New Delhi.
10	Preparation of Eye drops	4	R.S.Gaud., G.D.Gupta. Practical Pharmaceutics, Pg.125-144, CBS Publishers and distributors,New Delhi.
11	Preparation of Eye ointment.	4	R.S.Gaud., G.D.Gupta. Practical Pharmaceutics, Pg.125-144, CBS Publishers and distributors, New Delhi.
12	Preparation of cold cream	4	R.S.Gaud., G.D.Gupta. Practical Pharmaceutics, Pg.32, CBS Publishers and distributors, New Delhi.
13	Preparation of vanishing cream.	4	R.S.Gaud., G.D.Gupta. Practical Pharmaceutics, Pg.33, CBS Publishers and distributors, New Delhi.
14	Evaluation of glass containers (as per IP)	4	Indian Pharmacopoeia, The controller of publications, 1st edition, Vol.1, Pg.889-891, New Delhi.
15	Demonstration of production of spray dried lactose / milk powder using spray drier	4	Roop.K.Khar, S.P.Vyas. Lachman/Liberman's the theory and practice of industrial pharmacy, 4th edition, 2013, CBS publishers, New Delhi,

Recommended Books: (Latest Editions)

01. Herbert A.Lieberman, Leon Lachman and Joseph B.Schwartz. Pharmaceutical Dosage forms : Tableets, Volume-1 to 3, 2nd Edition, Revised and expanded. New York.Basel: Marcel Dekker, Inc. 1989.
02. Larry L.Augsburger, Stepher W.Hoag, pharmaceutical dosage forms- Tablets, Volume 1 . 3rd edition, New York: Informa Health Care USA. Inc; 2008.
03. Larry L.Augsburger, Stephen W.Hoag. Pharmaceutical dosage forms – Tablets, volume 2. 3rd Edition, New York: informa Health Care USA. Inc; 2008.
03. Larry L.Augsburger, Stephen W.Hoag. Pharmaceutical dosage forms – Tablets, volume 3. 3rd Edition, New York: informa Health Care USA. Inc; 2008.
04. Kenneth E.Avis, Herbert A.Lieberman and leon lachman. Pharmaceutical dosage form – Parenteral medications, volume-1. 2nd edition. New York : Marcel Dekker Inc; 1992.
05. Kenneth E.Avis, Herbert A.Lieberman and leon lachman. Pharmaceutical dosage form – Parenteral medications, volume-2. 2nd edition. New York : Marcel Dekker Inc; 1993.
06. Herbert A.Lieberman, Martin M.Rieger, Gilbert S.Banker. Pharmaceutical Dosage form disperse system, Volume-1. 2nd Edition. New York : Marcel Dekker Inc: 1996.
07. Gilbert S.Banker, Christopher T.Rhodes. Modern Pharmaceutics. 4th edition, New York : Informa Health Care Inc; 2009
08. Loyd V.Allen, Remington : The science and practice of pharmacy. 22nd edition. Philadelphia: pharmaceutical press; 2013
09. Roop K Khar, SP Vyas, Farhan J Ahmad, Gaurav K Jain. The theory and practice of industrial pharmacy. 4th edition. New Delhi: CBS publishers and Distributors, 2009.
10. Michael E.Aulton, Kevin M.G.Taylor. Pharmaceutics. The science of dosage form design. 4th edition. British, Elsevier; 2013.
11. Loyd V.Allen, Jr.Nicholas G.Popovich. Howard C.Ansel. Pharmaceutical Dosage forms. 9th edition. Philadelphia: Wolters Kluwer; 2011.
12. Jens T.Carstensen, C.T.Rhodes. Drug Stability-Principles and Practices. 3rd edition, New York: Marcel Dekker Inc; 2000.

BP 507 P

BP507P-PHARMACOLOGY-II
(Practical) 4Hrs/Week

Course Outcomes :

C507.1	To learn the importance of physiological salt solutions and to identify the effect of various drugs on isolated frog heart, blood pressure and heart rate of dog.
C507.2	To illustrate the diuretic activity of drugs in mice/rats
C507.3	To identify the dose response relationship, effect of drugs on DRC and to construct the drug concentrations by various bioassay methods using animal simulator software.
C507.4	To categorize the PA_2 and PD_2 value of drugs using rat anococcygeus muscle and guinea pig ileum.
C507.5	To interpret the effect of spasmogens and spasmolytics using rabbit jejunum.
C507.6	To predict various screening models for analgesic and anti-inflammatory.

Course Content:

S. No.	Name of the Experiment	Duration (Hrs)	References
01	Introduction to *in-vitro* pharmacology and physiological salt solutions.	6 hrs	Hand book of Experimental Pharmacology – S.K.Kulkarni; 3rd edition; Vallabh Prakashan publishers; Exp. No.:1
02	Effect of drugs on isolated frog heart.	3 hrs	Simulated experiments in Pharmacology using Ex-pharm probeta software
03	Effect of drugs on blood pressure and heart rate of dog.	6 hrs	
04	Study of diuretic activity of drugs using rats/mice.	3 hrs	Experiments in Pharmacology using animal simulator software
05	DRC of acetylcholine using frog rectus abdominis muscle.	3 hrs	1)Experiments in Pharmacology using animal simulator software 2)Simulated experiments in Pharmacology using Ex-pharm probeta software
06	Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively	3 hrs	
07	Bioassay of histamine using guinea pig ileum by matching method.	3 hrs	

08	Bioassay of oxytocin using rat uterine horn by interpolation method.	3 hrs	
09	Bioassay of serotonin using rat fundus strip by three point bioassay.	6 hrs	
10	Bioassay of acetylcholine using rat ileum/colon by four point bioassay.	6 hrs	
11	Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).	6 hrs	
12	Determination of PD_2 value using guinea pig ileum.	3 hrs	1)Experiments in Pharmacology using animal simulator software
13	Effect of spasmogens and spasmolytics using rabbit jejunum.	3 hrs	
14	Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.	3 hrs	2)Simulated experiments in Pharmacology using Ex-pharm probeta software
15	Analgesic activity of drug using central and peripheral methods	3 hrs	

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

Recommended Books (Latest Editions)

01. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
02. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
03. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
04. 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.
05. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology.
06. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
07. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
08. Modern Pharmacology with clinical Applications, by Charles R. Craig& Robert.
09. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK.Handbook of experimental pharmacology.Vallabh Prakashan.

BP 508 P

BP508P-PHARMACOGNOSY AND PHYTOCHEMISTRY II

(Practical) 4 Hours/Week

Course Outcomes :

C508.1	To remember the wide variety of the crude drugs and their sources by morphological characteristics.
C508.2	To identify the powder mixture and to report the types of adulterants and substituents present.
C508.3	To analyze and evaluate the powdered crude drug samples by morphological and microscopical characteristics.
C508.4	To isolate the drug from the given crude drug sample.
C508.5	To predict the crude drug by performing chromatographic techniques.

Course Content:

S. No.	Name of the Experiment	Duration (Hrs)	References
01	Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander	9 hrs	Practical pharmacognosy- Khandelwal K.R; 16th edition; Nirali prakasan
02	Exercise involving isolation & detection of active principles a.Caffeine-from tea dust. b.Diosgenin from Dioscorea c.Atropine from Belladonna d.Sennosides from Senna	12 hrs	Practical pharmacognosy- Dr C.K.Kokate; 5thedition; Vallabhprakashan publishers; Chapter: 10
03	Separation of sugars by Paper chromatography	12 hrs	Practical pharmacognosy- Dr C.K.kokate;5thedition; Vallabhprakashan publishers; Chapter: 9
04	TLC of herbal extract	9 hrs	Quality control of herbal drugs – Dr.Pulok.K.Mukherjee; Chapter 19
05	Distillation of volatile oils and detection of phytoconstitutents by TLC	9 hrs	Practical pharmacognosy- Dr C.K.kokate;5thedition; Vallabhprakashan publishers; Chapter: 9

06	Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh	9 hrs	Practical pharmacognosy- Dr C.K.kokate;5thedition; Vallabhprakashan publishers; Chapter: 05

Recommended Books: (Latest Editions)

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

III B.PHARMACY
6th SEMESTER

BP 601 T

BP601T-MEDICINAL CHEMISTRY – III
(Theory) 45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

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

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Course Outcomes :

C601.1	To recall the classification and nomenclature of drugs of natural and synthetic origin
C601.2	To explain the concept of prodrugs and their importance
C601.3	To identify the mechanism of action and therapeutic uses of drugs
C601.4	To understand the relationship between structure of compound and its biological activity
C601.5	To choose the synthetic route for selected category of drugs
C601.6	To discuss the approaches in drug design including QSAR, pharmacophore modeling, docking and combinatorial chemistry

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 superscripted by (#) as specified in the course and synthesis of drugs superscripted by (*)

Chapter / Topic	Duration (hrs)	References
UNIT – I - Antibiotics Historical background, nomenclature, stereochemistry, structure activity relationship, chemical degradation, classification and important products of the following classes. **β-Lactam antibiotics:** Penicillins#, Cepholosporins#, β- Lactamase inhibitors and Monobactams **Aminoglycosides:** Streptomycin, Neomycin and Kanamycin	**10**	1. Medicinal Chemistry, Ramarao Nadendla, Second edition, Pharma Med Press, 2013, Chapters 9,10,11,12,13, Pages from 73-140.

Tetracyclines#: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline and Doxycycline		2. Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, Sixth edition, Lipincott Williams & Williams, Wolters Kluwer Health (India) Pvt.Ltd, Part-II, Section -5,Chapter 38, Pages from1028-1083. 3. A Text Book of Medicinal Chemistry (Synthetic & Biochemical Approach), Volume-II, Surendra N.Pandeya, Third edition, 2006, SG Publishers, Chapters 29,30, Pages from 757-855.
UNIT – II - Antibiotics: **Macrolide#:** Erythromycin Clarithromycin and Azithromycin. **Miscellaneous:** Chloramphenicol* and Clindamycin. **Prodrugs:** Basic concepts and applications of prodrugs. **Antimalarials:** Etiology of malaria. **Quinolines:** SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine and sulphadoxine. **Biguanides and dihydro triazines:** Cycloguanil pamoate and Proguanil. **Miscellaneous:** Pyrimethamine, Artemisinin, Artesunate, Artemether and Atovoquone.	**10**	1.Medicinal Chemistry, Ramarao Nadendla, Second edition, Pharma Med Press, 2013, Chapters 9,10,11,12,13, Pages from 73-140 & Chapter 17,Pages from 164-178. 2.A Text Book of Medicinal Chemistry (Synthetic & Biochemical Approach), Volume-II, Surendra N.Pandeya, Third edition, 2006, SG Publishers, Chapter 24,Pages from 601-633 & Chapters 29,30, Pages from 757-855. 3.Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, Sixth edition, Lipincott Williams & Williams, Wolters Kluwer Health (India) Pvt.Ltd, Part-II, Section -5,Chapter 38, Pages from 1028-1083.
UNIT – III **Anti-tubercular Agents** **Synthetic anti tubercular agents:** Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide and Para amino salicylic acid.*	**10**	1.Medicinal Chemistry, Ramarao Nadendla, Second edition, Pharma Med Press, 2013, Chapters 14,15, Pages from 141-160 & Chapter 21,Pages from 212-228.

Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycin and Capreomycin sulphate. **Urinary tract anti-infective agents** **Quinolones:** SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin and Moxifloxacin. **Miscellaneous:** Furazolidone, Nitrofurantoin* and Methanamine. **Antiviral agents:** Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdin, Ribavirin, Saquinavir, Indinavir and Ritonavir.		2.A Text Book of Medicinal Chemistry (Synthetic & Biochemical Approach), Volume-II, Surendra N.Pandeya, Third edition, 2006, SG Publishers, Chapter 23,Pages from 586-600 & Chapter 27, Pages from 705-734. 3.Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, Sixth edition, Lipincott Williams & Williams, Wolters Kluwer Health (India) Pvt.Ltd, Part-II, Chapter 41, Pages from 1127-1146 & Chapter 43, Pages from 1193-1228.
UNIT – IV **Antifungal agents:** **Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin and Griseofulvin. **Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride and Tolnaftate*. **Anti-protozoal Agents:** Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone and Eflornithine. **Anthelmintics:** Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal and Ivermectin. **Sulphonamides and Sulfones** Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine, succinyl sulphathiazole, Phthalylsulfathiazole and	**08**	1. Medicinal Chemistry, Ramarao Nadendla, Second edition, Pharma Med Press, 2013, Chapter 7, Pages from 62-72 & Chapter 16,Pages from 161-163 & Chapters 18,19,20, Pgaes from -193-211. 2. A Text Book of Medicinal Chemistry (Synthetic & Biochemical Approach), Volume-II, Surendra N.Pandeya, Third edition, 2006, SG Publishers, Chapters 22,23,Pages from 547-600 & Chapter 25, Pages from 634-663 & Chapter 28, Pages from 735-756. 3. Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, Sixth edition, Lipincott Williams & Williams, Wolters Kluwer Health (India) Pvt.Ltd, Part-II,

sulphaguanidine. **Folate reductase inhibitors:** Trimethoprim* and sulphamethoxazole. **Sulfones:** Dapsone*.		Chapters 39,40, Pages from 1084-1126.
UNIT – V **Introduction to Drug Design** Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques. **Combinatorial Chemistry:** Concept and applications. Solid phase synthesis, solution phase synthesis and other techniques involved in combinatorial chemistry.	**07**	1. Medicinal Chemistry, Ramarao Nadendla, Second edition, Pharma Med Press, 2013, Chapters 4,5,6, Pages from 41-61. 2. Foye's Principles of Medicinal Chemistry, David A.Williams, Thomas L.Lenke, Sixth edition, Lipincott Williams & Williams, Wolters Kluwer Health (India) Pvt.Ltd, Part-I, Chapters 2,3,4 and 5, Pages from 26-114.

BP 602 T

BP602T - PHARMACOLOGY-III
(Theory) 45 Hours

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition,emphasis on the principles of toxicology and chronopharmacology.

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

1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. comprehend the principles of toxicology and treatment of various poisoningsand
3. appreciate correlation of pharmacology with related medical sciences.

Course Outcomes :

C602.1	To list the drugs used in respiratory and gastrointestinal complications
C602.2	To understand the principles of chemotherapy and illustrate the mechanism of action of antibiotics.
C602.3	To explain and compare the mechanism of anti-mycobacterial, anti-fungal, anti-viral,
C602.4	To analyze the chemotherapy of UTI's, STD's, anti-cancer drugs and to categorize the immunopharmacology.
C602.5	To assess the various types of toxicity studies, principles of treatment of poisoning and management of various poisoned conditions.
C602.6	To compile the biological clock and its significance leading to chronotherapy.

Course Content:

Chapter / Topic	Duration (hrs)	References
UNIT-I	**10 hrs**	1. Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-6, Chapter No.: 27 – 29 and Section-9, Chapter No.: 48 - 49. 2. Essentials of Medical Pharmacology - K.D. Tripathi; Jaypee publications; Section-4, Chapter No.: 16 and Section-11, Chapter No.: 46-48.
1. Pharmacology of drugs acting on Respiratory system	**4 hrs**	
a. Anti -asthmatic drugs	1 hr	
b. Drugs used in the management of COPD	1 hr	
c. Expectorants and antitussives	2 hrs	
d. Nasal decongestants		
e. Respiratory stimulants		
2. Pharmacology of drugs acting on the Gastrointestinal Tract	**6 hrs**	
a. Antiulcer agents.	2 hrs	
b. Drugs for constipation and diarrhoea.	1 hr	
c. Appetite stimulants and suppressants.	1 hr	
d. Digestants and carminatives.	2 hrs	
e. Emetics and anti-emetics.		

UNIT-II **Chemotherapy** a. General principles of chemotherapy. b. Sulfonamides and cotrimoxazole. c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolinies, tetracycline, aminoglycosides, lincosamide, oxazolidinones and streptogramins	**10 hrs** 2 hrs 1 hr 7 hrs	1. Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-11,Chapter No. : 52-58. 2. Essentials of Medical Pharmacology - K.D. Tripathi; Jaypee publications; Section-12, Chapter No.: 49-54
UNIT-III **Chemotherapy** a. Antitubercular agents b. Antileprotic agents c. Antifungal agents d. Antiviral drugs e. Anthelmintics f. Antimalarial drugs g. Antiamoebic agents	**10 hrs** 2 hrs 1 hr 1 hr 2 hrs 1 hr 2 hrs 1hr	Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-11,Chapter No. : 59-65.
UNIT-IV **1. Chemotherapy** a. Urinary tract infections and sexually transmitted diseases. b. Chemotherapy of malignancy. **2. Immunopharmacology** a. Immunostimulants b. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars	**08 hrs** **5 hrs** 1 hr 4 hrs **3 hrs** 1 hr 2 hrs	Principles of Pharmacology - H.L. Sharma & K.K. Sharma; 2nd edition; Paras publishers; Section-11,Chapter No. : 54 and Section-12,Chapter No. : 67
UNIT-V **1. Principles of toxicology** a. Definition and basic knowledge of acute, subacute and chronic toxicity. b. Definition and basic knowledge of genotoxicity,carcinogenicity, teratogenicity and mutagenicity c. General principles of treatment of poisoning d. Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning. **2. Chronopharmacology** a. Definition of rhythm and cycles. b. Biological clock and their significance leading to chronotherapy.	**07 hrs** **5 hrs** 1 hr 1 hr 1 hr 2 hrs **2 hrs** 1 hr 1 hr	1. OECD guidelines for testing of chemicals. 2. Schedule Y (Amended Version-2005-CDSCO); Pg.No.:16—31 3. Modern medical toxicology – VV.Pillay, 4th Edition, Jaypee Publications. Section-I;Chapter-4 4. Basic and Clinical Pharmacology-Bertram.G.Katzung,10th Edition, Mc Graw Hill publications, Chapter No.: 57-58. 5. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology

BP 603 T

BP603T-HERBAL DRUG TECHNOLOGY
(Theory) 45 hours

Scope: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

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

1. understand raw material as source of herbal drugs from cultivation to herbal drug product
2. know the WHO and ICH guidelines for evaluation of herbal drugs
3. know the herbal cosmetics, natural sweeteners, nutraceuticals
4. appreciate patenting of herbal drugs, GMP .

Course Outcomes :

C603.1	To recall the fundamental concepts of herbal raw materials and biodynamic agriculture techniques
C603.2	To understand the concept of neutraceuticals and herbal food interactions.
C603.3	To apply the knowledge for evaluation and preparation of herbal formulations.
C603.4	To remember the regulatory guidelines for the assessment of herbal drugs and patenting.
C603.5	To illustrate the scope and future prospects of the herbal drug industry.
C603.6	To establish and follow the SOP's, infrastructure of industries as per GMP

Course content:

Chapter / Topic	Duration (hrs)	References
UNIT-I	**11 hrs**	01. Pharmacognosy and phytochemistry, SL Deore,Dr.S.S.Khadabadi, 1st edition, 2014, Pharma med press (Chapter-1, 9) 02. Pharmacognosy and Pharmacobiotechnology, Ashutoshkar, 2nd edition , 2007, New age international pvt ltd, New Delhi, Chapter-1. 03. Text book of pharmacognosy, 2nd edition, 2006, S S Handa, V.K.Kapoor, Vallabh Prakashan, New Delhi, (Chapter-33, 34).
1.Herbs as raw materials Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbal materials Processing of herbal raw material	3 hrs	
2.Biodynamic Agriculture Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides / Bioinsecticides.	3 hrs	
3.Indian Systems of Medicine a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy	5 hrs	

b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.		04. Herbal Drug Technology, S S Agarwal, M.Paridhavi, 1st edition, 2007, Universities Press (India) Pvt. Ltd., Hyderabad, (Chapter 2) 05. Essential of pharmacognosy, Dr.S.H.Ansari, 1st edition, 2006, Birla Publications Pvt. Ltd,(Chapter-12) 06. Pharmacognosy, C K Kokate, A Purohit, 15th edition, 2014, Nirali Prakashan, Chennai (Chapter-18).
UNIT-II **1.Nutraceuticals** General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina **2.Herbal-Drug and Herb-Food Interactions:** General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.	**07 hrs** 5 hrs 2 hrs	01.Pharmacognosy and phytochemistry, SL Deore,Dr.S.S.Khadabadi, 1st edition, 2014, Pharma med press (Chapter-27) 02. Pharmacognosy and Pharmacobiotechnology, Ashutoshkar, 2nd edition , 2007, New age international pvt ltd, New Delhi, 03. Essential of pharmacognosy, Dr.S.H.Ansari, 1st edition, 2006, Birla Publications Pvt. Ltd,(Chapter-12, 16, 22) 04. Handbook of Medicinal herbs, James A.Duke, 2nd edition, 2006, C R C Press, New Delhi, 05. Quality control of herbal drugs, Dr.Pulok, K.Mukharjee, 5th edition, 2012, business horizons, New Delhi (Chapter 2) 06. Fundamentals of Pharmacognosy and phytotherapy, Michel Henrich, 2008, Church Living Stone, (Chapter, 9, 10), section 4.

UNIT-III **1.Herbal Cosmetics** Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products. **2.Herbal excipients:** Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. **3.Herbal formulations :** Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes	**10 hrs** 4 hrs 3 hrs 3 hrs	01. Herbal Drug Technology, S S Agarwal, M.Paridhavi, 1st edition, 2007, Universities Press (India) Pvt. Ltd., Hyderabad, (Chapter 11) 02.Pharmacognosy and phytochemistry, SL Deore, Dr.S.S.Khadabadi, 1st edition, 2014, Pharma med press (Chapter-20, 21, 26) 03. Essential of pharmacognosy, Dr.S.H.Ansari, 1st edition, 2006, Birla Publications Pvt. Ltd,(Chapter-16) 04. Pharmacognosy, C K Kokate, A Purohit, 15th edition, 2014, Nirali Prakashan, Chennai (Chapter-18).
UNIT- IV **1.Evaluation of Drugs** WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. **2.Patenting and Regulatory requirements of natural products:** a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. **3.Regulatory Issues** - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.	**10 hrs** 3 hrs 4 hrs 3 hrs	01.Pharmacognosy and phytochemistry, SL Deore, r.S.S.Khadabadi, 1st edition, 2014, Pharma med press (Chapter-11. 12. 23. 30) 02. Quality control of herbal drugs, Dr.Pulok, K.Mukharjee, 5th edition, 2012, business horizons, New Delhi (Chapter-17) 03. Herbal Drug Technology, S S Agarwal, M.Paridhavi, 1st edition, 2007, Universities Press (India) Pvt. Ltd., Hyderabad, (Chapter-10) 04. WHO monograph selected medicinal plants, Vol 1 and 2, AITBS publishers, and distributors, Indraprastha Press, New Delhi.

UNIT-V **1.General Introduction to Herbal Industry** Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. **2.Schedule T – GoodManufacturing Practice of Indian systems of medicine** Components of GMP (Schedule – T) and its objectives Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.	**07 hrs** 4 hrs 3 hrs	01. Text book of industrial pharmacognosy (PB) A.N.Kalia, 2nd edition, 2009, C B S Publishers and distributors, Chapter-4. 02. Pharmacognosy and phytochemistry, SL Deore, Dr.S.S.Khadabadi, 1st edition, 2014, Pharma med press (Chapter-10, 19)

BP 604 T

BP604T-BIOPHARMACEUTICS AND PHARMACOKINETICS
(Theory) 45 Hours

Scope: This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arised therein.

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

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
4. Understand various pharmacokinetic parameters, their significance & applications.

C604.1	To recall and understand basic concepts of absorption, distribution, metabolism and excretion of drugs.
C604.2	To understand the mechanisms, interpret various factors affecting drug absorption, distribution, metabolism and excretion of drugs.
C604.3	To utilize the pharmacokinetic models for the determination of pharmacokinetic parameters.
C604.4	To analyze the bioavailability of a drug and to compare the bioequivalence between drug products.
C604.5	To evaluate various pharmacokinetic parameters for the drugs exhibiting saturation kinetics.
C604.6	To design multiple dosage regimens based on pharmacokinetic parameters for maximizing patient compliance and therapeutic effectiveness.

Course Content:

Chapter / Topic	Duration (hrs)	References
UNIT-I **Introduction** **Biopharmaceutics to Absorption**; Mechanisms of drug absorption through GIT, pH partition theory and limitations, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes.	**10**	01.Leon Shargel, susanna Wu-Pong, Andrew B.C.Yu. Applied Biopharmaceutics and Pharmacokinetics. 5th edition, Asia : McGraw Hill Education, 2005. Chapter 7: P.161-184. 02.Gilbert S.Banker, Christopher T.Rhodes.Modern Pharmaceutics. 4th Edition, USA. Informa Health Care, 2009. Chapter 2: Drug Absorption, Pg.23-61.

Distribution Tissue permeability of drugs, binding of drugs, apparent volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs		03. Leon Shargel, Susanna Wu-Pong, Andrew B.C.Yu.Applied Biopharmaceutics and Pharmacokinetics. 5th Edition, Asia:McGraw Hill Education, 2005. Chapter 10; Distribution, P.251-301.
UNIT- II **Elimination:** Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs **Bioavailability and Bioequivalence:** Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.	**10**	01.Malcolm Rowland, Ph.D., Thomas N.Tozer, Ph.D., Clinical Pharmcokinetics concept and applications, 3rd Edition, Philadelphia : Lippincott Williams and Wilkins : 1995. Chapter II, P.156-183. 02.Leon Shargel, susanna wu, Andrew B.C.Yu. Applied Biopharmaceutics and Pharmacokinetics, 5th Edition. Asia : Mc Graw-Hill Education : 2005, Chapter-6; P.131-160 03. Leon Shargel, susanna Wu, Andrew B.C.Yu.Applied Biopharmaceutics and Pharmacokientics, 5th edition. Asia : McGraw-Hill Education : 2005. Chapter 15; P.453-498.
UNIT- III **Pharmacokinetics:** Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_e, $t_{1/2}$, V_d, AUC, K_a, Cl_T and Cl_R- definitions methods of eliminations, understanding of their significance and application.	**10**	01.Leon shargel, susanna wu, Andrew B.C.-Yu.Applied Biopharmaceutics and pharmacokinetics. 5th edition. Asia : McGraw-Hill Education: 2005. Chapter 3; p.51-72

UNIT- IV ***Multicompartment models:*** Two compartment open model. iv bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical setting.	**08**	01.Leon Shargel, Susanna Wu, Andrew B.C.Yu. Applied Biopharmaceutics and Pharmacokinetics. 5th Edition. Asia : McGraw-Hill Education : 2005. Chapter 4; P.73-105.
UNIT- V **Nonlinear Pharmacokinetics:** a. Introduction, b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.	**07**	01.Leon Shargel, Susanna Wu, Andrew B.C.Yu. Applied Biopharmaceutics and Pharmacokinetics. 5th Edition. Asia : McGraw-Hill Education : 2005. Chapter 9; P.219-248 02.Malcon Rowland, Ph.D., Thomas.N.Tozer, Ph.D. Clinical Pharmacokinetics Concept & Application. 3rd Edition, Philadelphia : Lippincott Williams and Wilkins: 1995. Chapter 22, P.394-423.

Recommended Books: (Latest Editions)

01 Milo Gibaldi. Biopharmaceutics and clinical pharmacokinetics. 4th edition, Hyderabad: Pharma Book Syndicate : 2005.

02. Robert.E.Notari.Biopharmaceutics and clinical pahrmacokinetics: 4th edition. New York:Marcel Dekker Inc. 1987.

03. Leon Shargel, Susanna.W.U., Andrew B.C.Yu. Applied Biopharmaceutics and pharmacokinetics. 5th edition. Asia: Mc.Graw Hill Education; 2005.

04. Brahmankar D M, Sunil.B.Jaiswal. Biopharmaceutics and pharmacokinetics Atreatise. New Delhi: vallabh Prakashan, 2009.

05. Milo Gibaldi.Donald Perrier. Pharmacokinetics.2nd edition (Revised and expanded). New York: Marcel Dekker; 1982.

06. James Swarbrick, James C Boylan. Encyclopedia of Pharmaceutical Technology. 2nd edition. New York:Marcel Dekker Inc. ; 2002. Vol.1, Pg.No.156-176.

07. Malcom Rowland.Thomas N.Tozer.Clinical Pharmacokinetics; Concepts and Applications. Philadesphia: Wolters Kluwer and Lippincott Williams and Wilkins; 1995.

08. Hamed M.Abdov.Dissolution, Bioavailability and bioequivalence.1st edition, Pennsylvania: Mack Publishing company; 1989.

09. Loyd V.allen Jr.Remington: The science and practice of pharmacy, 22nd edition. Philadelphia: Pharmaceutical press : 2013.

BP 605 T

BP605T-PHARMACEUTICAL BIOTECHNOLOGY
(Theory) 45 Hours

- Biotechnology has a long promise to revolutionize the biological sciences and technology.
- Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technologymakes the subject interesting.
- Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs.
- Biotechnology has already produced transgenic crops and animals and the future promises lot more.
- It is basically a research-based subject.

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

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

Course Outcomes :

C605.1	To remember the basic concepts of biotechnology with respect to enzyme technology, immunology, microbial technology, genetic engineering and protein engineering.
C605.2	To understand the steps involved in development of biosensors, recombinant products and concepts of immunology.
C605.3	To outline the production parameters important in pharmaceutical product development using principles of biotechnology.
C605.4	To compare the genetic organization of different types of cells and to list detection methods at genomic level, gene transfer methods and mutagens.
C605.5	To explain general requirements of fermentative production and biotechnological production of pharmaceuticals.
C605.6	To elaborate on microbial genetics, biotransformation and various immunological products.

Course Content:

Chapter/Topic	Duration (hrs)	References
Unit I a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.	**10**	1. K. Samabamurthy, AshutoshKar. Pharmaceutical Biotechnology, New Age international publishers.1st edition, chapter 5;309-334; 2010

c)Biosensors- Working and applications of biosensors in Pharmaceutical Industries. d)Brief introduction to Protein Engineering. e)Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. f)Basic principles of genetic engineering.		2. K. Samabamurthy, AshutoshKar. Pharmaceutical Biotechnology, New Age international publishers.1st edition, chapter 2 ;119-155, 2010
Unit II a) Study of cloning vectors, restriction endonucleases and DNA ligase. b) Recombinant DNA technology. Application of genetic engineering in medicine. c) Application of r-DNA technology and genetic engineering in the production of: i) Interferon ii) Vaccines- hepatitis-B iii) Hormones-Insulin. d) Brief introduction to PCR	**10**	01.K. Samabamurthy, Ashutoshkar. Pharmaceutical Biotechnology, New Age international publishers.1st edition, chapter 2 ;119-155, 2010 02.S.P. Vyas , V.K. Dixit. Pharmaceutical Biotechnology, CBS publishers New Delhi. 1st edition reprint 2007, chapter 10;341-400, reprint 2007.
Unit III Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins b) Structure and function of MHC c) Hypersensitivity reactions, Immune stimulation and Immune suppressions. d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. e) Storage conditions and stability of official vaccines f) Hybridoma technology- Production, Purification and Applications g) Blood products and Plasma Substituties.	**10**	1.Joann M. Willey, Linda M. Sherwood, Christopher. J. Woolverton. Prescott's Microbiology. McGraw-Hill international publishers, 8th edition. chapter 32;760-784, 2011. 2.K.Samabamurthy, AshutoshKar. Pharmaceutical Biotechnology, New Age international publishers.1st edition, chapter 2 ;158-161, 2010.

Unit IV a) Immuno blotting techniques-ELISA, Western blotting, Southern blotting. b) Genetic organization of eukaryotes and prokaryotes c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. d) Introduction to microbial biotransformation and applications. e) Mutation: Types of mutation/mutants.	**08**	1. K. Samabamurthy, Ashutoshkar. Pharmaceutical Biotechnology, New Age international publishers.1st edition, chapter 4 ;261-304, 2010 2. Joann M. Willey, Linda M. Sherwood, Christopher. J. Woolverton. Prescott's Microbiology. McGraw-Hill international publishers, 8th edition. chapter 35;850-871, 2011
Unit V a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. b) Large scale production fermenter design and its various controls. c) Study of the production of – penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, d) Blood Products: Collection, Processing and storage of whole human blood, dried human plasma, plasma substituties.	**07**	1.P. F. Stanbury, A. Whitaker, S. J. Hall. Principles of fermentation Technology. Elsevier Science Ltd.2nd edition. Indian print. Chapter 7,8,9.Page:167-272, 1995. 2.Wulf Crueger and Anneliese Crueger. Biotechnology. A text book of Industrial Microbiology.2nd edition. Panima publishers corporation, New Delhi. Chapter- 8,12,13;pgae 134-270, 2005

Recommended Books (Latest edition):

01. Behard R.Glick, Chery L.pattew, Harback.Molecular Biotechnology principles and applications of Recombinant DNA: 5th edition. Washington. ASM press; 1994.1998, 2003, 2010.
02. Judith A Owen, Jenni Punt, Sharon A Stanford, Patricia P.Jones, Janis Kuby.Immunology:7th Edition.Basingstoke:MacMillan Higher Education; 2013.
03 James Goding. Monoclonal Antibodies: 3rd Edition. Academic press; 1996.
04. J.W.Walker and E.B.Gingold. Molecular Biology and Biotechnology: 3rd edition. Elsevier Inc. 1994.
05. Wayne H.Pitcher. Immobilized Enzymes for food processing: 1st Edition. CRC Press, 2017.
06. S.B.Pimrose.Molecular Biotechnology:2nd edition. Panima Book Distributors; 2001.
07. P.F.Stranbury, A.Whitaker. Principles of Fermentation technology:2nd edition. Elsevier; 1995.

BP 606 T

BP606T-PHARMACEUTICAL QUALITY ASSURANCE
(Theory) 45 Hours

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

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

- understand the cGMP aspects in a pharmaceutical industry
- appreciate the importance of documentation
- understand the scope of quality certifications applicable to pharmaceutical industries
- understand the responsibilities of QA & QC departments

Course Outcomes :

C606.1	To remember the concepts of quality assurance, quality management and ICH guidelines.
C606.2	To explain the ISO, NABL and QbD concepts in pharmaceutical industry.
C606.3	To identify the organization and personnel responsibilities.
C606.4	To analyze quality control parameters and good laboratory practices in pharmaceutical industry.
C606.5	To evaluate the complaints and documents maintenance in industry with required regulatory guidelines.
C606.6	To elaborate the calibration, validation procedures and good warehousing practices.

Course content:

Chapter/Topic	Duration (hrs)	References
UNIT – I **Quality Assurance and Quality Management concepts:** Definition and concept of quality control, quality assurance and GMP. **Total Quality Management (TQM):** Definition, elements and philosophies. **ICH Guidelines**: purpose, participants, process of harmonization, brief overview of QSEM, with special emphasis on Q-series guidelines and ICH stability testing guidelines. **Quality by design (QbD)**: Definition, overview, elements of QbD program and tools.	**10**	1. Pharmaceutical regulatory affairs, C.V.S.Subramanyam, Vallabh Prakashan publication, 2012, Chapter 04. 2. Pharmaceutical Quality Assurance, Manohar A.Potdar, Nirali Prakashan Publication, 2006, Chapter 05. 3. Handbook of pharmaceutical quality assurance, Premnath Shenoy, First edition, Omkar offset printers, 2016, Chapter 18.

ISO 9000 & ISO14000: Overview, benefits, elements and steps for registration. **NABL accreditation** : Principles and procedures.		4.Pharmaceutical regulatory affairs, C.V.S.Subramanyam, Vallabh Prakashan publication, 2012, Chapter 04. 5.Quantitative analysis of drugs in pharma-ceutical formulations, P.D.Sethi, Third edition, CBS publishers and distributors, 1997, Chapter 04.
UNIT - II **Organization and personnel:** Personnel responsibilities, training, hygiene and personal records. **Premises:** Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas and control of contamination. **Equipments and raw materials:** Equipment selection, purchase specifications and maintenance of stores for raw materials.	**10**	1.Pharmaceutical Quality Assurance, Manohar A.Potdar, Nirali Prakashan Publication, 2006, Chapter 01 & Chapter 02. 2.Handbook of pharmaceutical quality assurance, Premnath Shenoy, First edition, Omkar offset printers, 2016, Chapter 18.
UNIT – III **Quality Control:** Quality control test for containers, rubber closures and secondary packing materials. **Good Laboratory Practices:** General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports and Disqualification of Testing Facilities.	**10**	1.Quantitative analysis of drugs in pharmaceutical formulations, P.D.Sethi, Third edition, CBS publishers and distributors, 1997, Chapter 04. 2.Pharmaceutical Quality Assurance, Manohar A.Potdar, Nirali Prakashan Publication, 2006, Chapter 01 & Chapter 05. 3.Drug regulatory affairs, V.Sai kishore, IKON books, 2011, Chapter 06.
UNIT – IV **Complaints:** Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. **Document maintenance in pharmaceutical industry:** Batch formula record, master formula	**08**	1.Pharmaceutical Quality Assurance, Manohar A.Potdar, Nirali Prakashan Publication, 2006, Chapter 01 & Chapter 04 & Chapter 07

record, SOP, quality audit, quality review and quality documentation, reports & documents, distribution records, change control, OOT and OOS.		2.Handbook of pharmaceutical quality assurance, Premnath Shenoy, First edition, Omkar offset printers,2016,Chapter 02 3.Pharmaceutical regulatory affairs, C.V.S.Subramanyam, Vallabh Prakashan publication, 2012, Chapter 08.
UNIT – V **Calibration and Validation:** Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation includes equipment validation and validation master plan. Calibration of pH meter, qualification of UV-Visible spectrophotometer and general principles of analytical method validation. **Warehousing:** Good warehousing practice and materials management.	**07**	1.Handbook of pharmaceutical quality assurance, Premnath Shenoy, First edition, Omkar offset printers, 2016, Chapter 06. 2.Drug regulatory affairs, V.Sai kishore, IKON books, 2011, Chapter 04. 3.Quantitative analysis of drugs in pharmaceutical formulations, P.D.Sethi, Fourth edition, CBS publishers and distributors, 2012, Chapter 03.

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, SandyWeinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol IWHO Publications.
4. A guide to Total QualityManagement- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total QualityManagement – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

BP 607 P

BP607P - MEDICINAL CHEMISTRY- III
(Practical) (60 hours)

Course Outcomes :

C607.1	To define and select the method for preparation of drugs and intermediates
C607.2	To explain principle underlying the preparation of drugs
C607.3	To choose the method for assay of drugs by quantitative analysis
C607.4	To compare the advantages of microwave technique over conventional synthesis of drugs
C607.5	To select the tools needed for drawing structures and reactions
C607.6	To predict the relation between physicochemical properties and biological activity

Course content:

S. No.	Name of the Experiment	Duration (Hrs)	References
I	**Preparation of drugs and intermediates**		
1	Sulphanilamide	4 hrs	Mann and Saunders, Practical Organic Chemistry, 4th edition, Pg.No.181.
2	7-Hydroxy-4-methyl coumarin	4 hrs	Mann and Saunders, Practical Organic Chemistry, 4th edition, Pg.No. 307.
3	Chlorbutol	3 hrs	Bentley and Driver's Textbook of Pharmaceutical Chemistry, 8th edition, Pg.No.343, 344, Oxford University Press.
4	Triphenyl imidazole	3 hrs	Vogel's text book of Practical Organic Chemistry, 5th edition, Pg.No. 181.
5	Tolbutamide	3 hrs	The Organic Chemistry of Drug synthesis by Lednicer, Vol-1, Pg.No. 136.
6	Hexamine	3 hrs	Bentley and Driver's Textbook of Pharmaceutical Chemistry, 8th edition, Pg.No.361, Oxford University Press.

II	**Assay of drugs**		
7	Isonicotinic acid hydrazide	3 hrs	• Indian pharmacopoeia 2018 edition, volume II, Pg.No. 2321. • Pharmaceutical Drug Analysis by Ashutoshkar, 1st edition, Pg.No.193.
8	Chloroquine	3 hrs	• Indian pharmacopoeia 2018 edition, volume II, page no 1590. • Pharmaceutical Drug Analysis by Ashutoshkar, 1st edition, Pg.No. 330.
9	Metronidazole	3 hrs	• Indian pharmacopoeia 2018 edition, Vol.II, page no 2543. • Pharmaceutical Drug Analysis by Ashutoshkar, 1st edition, Pg.No. 112 .
10	Dapsone	3 hrs	• Indian pharmacopoeia 2018 edition ,Vol.II, Pg.No. 1758. • Pharmaceutical Drug Analysis by Ashutoshkar, 1st edition, Pg.No. 211.
11	Chlorpheniramine maleate	3 hrs	• Indian pharmacopoeia 2018 edition , Vol. II, Pg.No. 1596. • Pharmaceutical Drug Analysis by Ashutoshkar, 1st edition, Pg.No. 14.
12	Benzyl penicillin	3 hrs	• Indian pharmacopoeia 2018 edition ,Vol.II, Pg.No. 1358. • Pharmaceutical Drug Analysis by Ashutoshkar, 1st edition, Pg.No. 184,142.
13	Preparation of medicinally important compounds or intermediates by Microwave irradiation technique	6 hrs	• New Trends in Green Chemistry by V.K Ahluwalia & M. Kidwai; 2nd edition.
14	Drawing structures and reactions using chem draw®	6 hrs	• Chemdraw software, Cambridge soft, version 17.0, September 2017

15	Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)	10 hrs	• QSAR & Molecular modeling by S.P Gupta, 2011; Models of QSAR analysis, 59-111

Recommended Books (Latest Editions)

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

BP 608 P

BP608P - PHARMACOLOGY-III
(Practical) 4Hrs/Week

Course Outcomes :

C608.1	To recall the dose calculations in pharmacological experiments, and to relate the antiallergic activity / anti-ulcer activity in rat models.
C608.2	To demonstrate of effect of drugs on gastrointestinal motility and the effect of agonist/antagonists on guinea pig ileum
C608.3	To construct serum biochemical parameters by using semi auto analyzer.
C608.4	To analyze effect of saline purgative on frog intestine, insulin hypoglycemic effect and test for pyrogens using rabbit method.
C608.5	To evaluate acute oral toxicity (LD50), acute skin irritation / corrosion and acute eye irritation / corrosion of a test substance
C608.6	To predict the pharmacokinetic parameters and adapt the biostatistics methods in experimental pharmacology.

Course content:

S. No.	Name of the Experiment	Duration (Hrs)	References
01	Dose calculation in pharmacological experiments	3 hrs	1) Hand book of Experimental Pharmacology – S.K.Kulkarni; 3rd edition; Vallabh Prakashan publishers; Exp. No.:1 2) Fundamental of Experimental Pharmacology, M.N.Ghosh, 3rd edition, Hillton and company, Chapter 2 and 4
02	Antiallergic activity by mast cell stabilization assay		1.Hand book of Experimental preclinical pharmacology – Sanjay B Kasture, career publications, experiment no. 44. 2.Experiments in Pharmacology using Animal simulator Software
03	Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.	3 hrs	1. Drug discovery and evaluation, pharmacological assays H.Gerhard Vogel, 2nd edition, Chapter-J 3.7 2.Experiments in Pharmacology using Animal simulator Software
04	Study of effect of drugs on gastrointestinal motility	3 hrs	1. Drug discovery and evaluation, pharmacological assays H.Gerhard Vogel, 2nd edition, Chapter-J 4.3 2.Experiments in Pharmacology using Animal simulator Software

05	Effect of agonist and antagonists on guinea pig ileum		Experiments in Pharmacology using Animal simulator Software
06	Estimation of serum biochemical parameters by using semi-autoanalyser	3 hrs	Experiments in Pharmacology using Animal simulator Software
07	Effect of saline purgative on frog intestine	3 hrs	Experiments in Pharmacology using Animal simulator Software
08	Insulin hypoglycemic effect in rabbit	6 hrs	1. Drug discovery and evaluation, pharmacological assays H.Gerhard Vogel, 2nd edition, Chapter-K1.0.2 2. Experiments in Pharmacology using Animal simulator Software
09	Test for pyrogens (rabbit method)	3 hrs	1.Introduction to experimental pharmacology-Dr.Umabhandari, Birla publications, chapter, 11, exp.no. 25. 2. Experiments in Pharmacology using Animal simulator Software
10	Determination of acute oral toxicity (LD50) of a drug from a given data	6 hrs	Hand book of experimental pharmacology- S.K.Kulkarni, 3rd edition, vallabah prakashan publishers, section-iv, exp.no.4.26
11	Determination of acute skin irritation / corrosion of a test substance	6 hrs	1.Introduction to experimental pharmacology-Dr.Umabhandari, Birla publications, chapter, 11, exp.no. 08. 2. Experiments in Pharmacology using Animal simulator Software
12	Determination of acute eye irritation / corrosion of a test substance	6 hrs	1.Introduction to experimental pharmacology-Dr.Umabhandari, Birla publications, chapter, 11, exp.no. 08. 2. Experiments in Pharmacology using Animal simulator Software
13	Calculation of pharmacokinetic parameters from a given data	6 hrs	01.Practicals in pharmacology by Dr.R.K.Goayal, 8th edition, B.S.Shah -prakashan publications, exp.no.59
14	Biostatistics methods in experimental pharmacology(student's t test, ANOVA)	6 hrs	Hand book of experimental pharmacology- S.K.Kulkarni, 3rd edition, vallabah prakashan publishers, section-v

15	Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)	6 hrs	

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil 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 Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

BP 609 P

BP609P-HERBAL DRUG TECHNOLOGY
(Practical) 4 hours/ week

Course Outcomes :

C609.1	To remember different preliminary phytochemical screening of crude drugs
C609.2	To evaluate the various herbal formulations
C609.3	To apply monographic analysis of herbal drugs as per pharmacopoeias
C609.4	To evaluate parameters such as aldehyde and phenol contents
C609.5	To assess the total alkaloid content

Course content:

S. No.	Name of the Experiment	Duration (Hrs)	References
01	To perform preliminary phytochemical screening of crude drugs.	6 hrs	Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002, Part-1, Unit-10
02	Determination of the alcohol content of Asava and Arista	9 hrs	01. Pharmacognosy and phytochemistry, SL Deore, Dr.S.S.Khadabadi, 1st edition, 2014, Pharma med press (Chapter-13)
03	Evaluation of excipients of natural origin	6 hrs	Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002, Part-1, unit-2
04	Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.	9 hrs	01.Indian standards for oxidational herbal dyes, liquid, gel and cream – specifrication, 3rd revision. 02.Indian standard, shampoo, soap based, specification , 1st revision.
05	Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.	6 hrs	Pharmaceutical dosage forms: Tablets, 3rd edition, vol.2, rational design and formulation, Larry L Augsburger, chapter-11.

06	Monograph analysis of herbal drugs from recent Pharmacopoeias	6 hrs	Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002, part-2, unit-10
07	Determination of Aldehyde content	6 hrs	Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals, Business Horizons Publishers, New Delhi, India, 2002, part-2, unit-10
08	Determination of Phenol content	6 hrs	Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002, part-2, unit-10
09	Determination of total alkaloids	6 hrs	The ayurvedic pharmacopoeia of India, Part-1, vol. V,1st edition, Appendix-2, Pg.No.221

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

IV B.PHARMACY
7th SEMESTER

BP 701 T

BP701T-INSTRUMENTAL METHODS OF ANALYSIS
(Theory) 45 Hours

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis.
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course Outcomes :

C701.1	To understand selected instrumental analytical techniques (spectroscopic and chromatographic methods) and differentiate with volumetric analysis.
C701.2	To gain knowledge on interaction of EMR with matter and to build the analytical understanding at the level of atom, group and molecular structure of organic and inorganic compounds with different functional groups and their applications in pharmacy.
C701.3	To maximize knowledge on characterization and estimation of ions by spectroscopical techniques
C701.4	To simplify affinity of matter with stationary phase and mobile phase, physical and chemical properties of matter
C701.5	To elaborate various principles, theory and instruments employed for the characterization and analysis of drugs.
C701.6	To categorize different organic and inorganic compounds using suitable spectroscopic and chromatographic techniques.

Course Content:

Chapter / Topic	Duration (hrs)	References
UNIT –I **UV Visible spectroscopy** Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube,	**10**	1. Instrumental Methods of Chemical Analysis by B.K Sharma, 1st Editio, Krishna Publications, 1972, Chapter No: 02, P.No: 68.

Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications - Spectrophotometric titrations, Single component and multi component analysis **Fluorimetry** Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications		2. Organic spectroscopy by Y.R Sharma, Multicolour edition, S.CHAND, Chapter No: 02, P.No: 9-64. 3. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 4th, CBS, Chapter No: 07 & 09, P.No: 275-337 & 358-378. 4. Organic spectroscopy by William Kemp 3rd, PALGRAVE, Chapter No: 04, P.No: 243-269. 5. Instrumental methods of chemical analysis Gurdeep R.Chatwal, Sham K.Anand, 5th edition, Himalaya publishers, Chapter 16, Pg.2.399.
UNIT –II **IR spectroscopy** Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications **Flame Photometry-**Principle, interferences, instrumentation and applications **Atomic absorption spectroscopy**- Principle, interferences, instrumentation and applications **Nepheloturbidometry**- Principle, instrumentation and applications	**10**	1. Instrumental Methods of Chemical Analysis by B.K Sharma, 1st Edition, Krishna Publications, 1972, Chapter No: 03, P.No: 193. 2. Organic spectroscopy by Y.R Sharma, Multicolour edition, S.CHAND, Chapter No: 03, P.No: 69. 3. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 4th, CBS, Chapter No:10,P.No: 379. 4. Quantitative Analysis of Drugs by D. C. Garrett, Third edition, CBS, 2004, Chapter No: 16, P.No: 881. 5. Spectrophotometric identification of Organic Compounds by Silverstein Sixth edition, WILEY, 2007, Chapter No: 03, P.No: 71.

		6. Instrumental Methods of Chemical Analysis by B.K Sharma, 1st Edition, Krishna Publications, 1972, Chapter No: 05, 06 & 10, P.No: 383, 421 & 576. 7. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel, 6th Pearson, Chapter No: 15, P.No: 612. 8. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 4th, CBS, Chapter No:08,P.No: 338. 9. Quantitative Analysis of Drugs by D. C. Garrett, Third edition, CBS, 2004, Chapter: 14, P.No: 870.
UNIT –III **Introduction to chromatography** **Adsorption and partition column chromatography-**Methodology, advantages, disadvantages and applications. **Thin layer chromatography-** Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications. **Paper chromatography-** Introduction, methodology, development techniques, advantages, disadvantages and applications **Electrophoresis**– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications	**10**	1. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 4th, CBS, Chapter No: 04, P.No: 85. 2. Instrumental Methods of Chemical Analysis by B.K Sharma, 1st Editio, Krishna Publications, 1972, Chromatography Chapter No: 05, 06, 10, 11, 12, and 13, P.No: 96, 113, 225, 241 and 268
UNIT –IV **Gas chromatography -** Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications	**08**	1. Text book of Pharmaceutical Analysis by Kenneth A. Connors, Third, WILEY, Chapter No:17&18,P.No:373, 439.

High performance liquid chromatography (HPLC)- Introduction, theory, instrumentation, advantages and applications.		2. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 4th, CBS, Chapter No: 04, P.No: 128, 157. 3. Quantitative Analysis of Drugs by D. C. Garrett, Third edition, CBS, 2004, Chapter: 15, P.No: 876.
UNIT –V **Ion exchange chromatography-** Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications **Gel chromatography-** Introduction, theory, instrumentation and applications **Affinity chromatography-** Introduction, theory, instrumentation and applications	**07**	1. Instrumental Methods of Chemical Analysis by B.K Sharma, 1st Editio, Krishna Publications, 1972, Chromatography, chapter 7 and 8, Pg.No: 123, 161. 2. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake 4th, CBS, Chapter No: 04, P.No: 96, 99.

BP 702 T

BP702T-INDUSTRIAL PHARMACY-II
(Theory) 45 Hours

Scope: This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market

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

1. Know the process of pilot plant and scale up of pharmaceutical dosage forms
2. Understand the process of technology transfer from lab scale to commercial batch
3. Know different Laws and Acts that regulate pharmaceutical industry
4. Understand the approval process and regulatory requirements for drug products

Course Outcomes :

C702.1	To explains pilot plant scale up techniques and SUPAC guidelines.
C702.2	To outline various aspects of technology transfer involved from R & D to productions.
C702.3	To choose and to apply various responsibilities and regulatory requirements for drug approval.
C702.4	To analyze and study various quality management systems in pharmacy field.
C702.5	To determine the requirements and approval procedures for new drugs by Indian Regulatory.
C702.6	To discuss about approval process and regulatory requirements for drug products.

Course Content:

Chapter / Topic	Duration (hrs)	References
UNIT-I **Pilot plant scale up techniques:** General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology	**10**	01. J.R Berry, Nash, Pharmaceutical Process validation, Vol.57, Marcel Dekker, NY. 02. GC Cole, Tylor and Francis Pharmaceutical production facilities, design and application.
UNIT-II **Technology development and transfer:** WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification	**10**	01. J.R Berry, Nash, Pharmaceutical Process validation, Vol.57, Marcel Dekker, NY. 02. Evans, Anderson and Williams, Applied Production and Operation management.

and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues		03. Willing S.H.Marcel and Dekker, GMP for pharmaceuticals.
UNIT-III **Regulatory affairs:** Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals **Regulatory requirements for drug approval:** Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.	**10**	01.Douglar J Pisano and Pavid S.Mantus, Text book of FDA Regulatory Affairs A guide for prescription drugs, medical devices and biologic and 2nd edition. 02.T.Knennedy, Pharmaceutical project management, Vol.86, Marcel Dekker, NY. 03. GC cole, Taylor and Francis, Pharmaceutical Production facilities, Design and Applications.
UNIT-IV **Quality management systems:** Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP	**08**	01. J R Berry, Nash, Pharmaceutical process validation, Vol.57, Marcel Dekker, NY.
UNIT-V **Indian Regulatory Requirements:** Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.	**07**	01. Evans, Anderson and Williams, Applied production and operations management. 02. Douglas J Pisano and David S.Mertus. Text book of FDA regulatory Affairs a guide for prescription drugs, medical devices and biologic's, 2nd edition.

BP 703 T

BP703T-PHARMACY PRACTICE
(Theory) 45 Hours

Scope: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up.

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

01. know various drug distribution methods in a hospital
02. appreciate the pharmacy stores management and inventory control
03. monitor drug therapy of patient through medication chart review and clinical review
04. obtain medication history interview and counsel the patients
05. identify drug related problems
06. detect and assess adverse drug reactions
07. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
08. know pharmaceutical care services
09. do patient counseling in community pharmacy;
10. appreciate the concept of Rational drug therapy.

Course Outcomes :

C703.1	To acquire the knowledge on organization of hospitals, various methods of distribution and hospital formulary in hospitals and apply it in the practice of pharmacy.
C703.2	To outline the organization and structure of community pharmacy and to build ability to design and run own community pharmacy.
C703.3	To demonstrate the knowledge of therapeutic drug monitoring, patient medication history interview and to apply the knowledge on assessment of drug related problems.
C703.4	To categorize and evaluate the role of hospital pharmacist in pharmacy and therapeutic committee, drug information services, patient counseling, education and training programmes in hospitals.
C703.5	To explain the principles of drug store management and inventory control methods during practice.
C703.6	To interpret clinical laboratory tests of specific disease states to provide better patient centered service.

Course Content:

Chapter / Topic	Duration (hrs)	References
Unit I: **a) Hospital and it's organization** Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions. **b) Hospital pharmacy and its organization** Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists. **c) Adverse drug reaction** Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management. **d**) **Community Pharmacy** Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.	**10**	a)Hospital and clinical pharmacy-pratibhanand, page-3. b) Hospital pharmacy pradhhar, page no. 1-1. c) Modern dispensing and hospital pharmacy, N.K.Jain, page.No.309. d) A text book of clinical pharmacy practice, G.Parthasarathi, 2nd edition, page.no.104. e)Text book of community pharmacy, chapter-8, Adepu Ramesh, page no. 56.
Unit II: (10 Hours) **a) Drug distribution system in a hospital :** Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.	**10**	a) Hospital pharmacy, Anand paradkar, chapter 9. Page no. 9. b) Model dispensing and hospital pharmacy, N.K.Jain, chapter-17, page no.327.

b) Hospital formulary Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary. **c) Therapeutic drug monitoring** Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic DrugMonitoring, and Indian scenario for Therapeutic Drug Monitoring. **d) Medication adherence** Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence. **e) Patient medication history interview** Need for the patient medication history interview, medication interview forms. **f) Community pharmacy management** Financial, materials, staff, and infrastructure requirements.		c) Model dispensing and hospital pharmacy, N.K.Jain, chapter 19, page no. 379. d) Merchant S.H.and Dr.J.S.Quadry, A textbook of hospital pharmacy, 4th edition page no. 39. e) Parthasarathi G, Karhn Nyfort- Hansen, Milop C Nahati, A text book of clinical pharmacy practice essential concepts and skills. 1st edition, Pg.No.395
Unit III: **a) Pharmacy and therapeutic committee** Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation. **b) Drug information services** Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information. **c) Patient counseling** Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist **d) Education and training program in the hospital** Role of pharmacist in the education and training program, Internal and external training program, Services to	**10**	a)Tipnis Bajaj. Hospital Pharmacy 1st edition, Chapter-4, page no. 77. b)Parthasarathi G, Karin Nytori-Hassen, Milap (Nagata A text book of clinical pharmacy practice essential concepts and skills, 1st edition, page no. 267. c)William E.Hassan hospital pharmacy, 5th edition, chapter 26, Page No. 566. d)Parthasarthi G. Karin Nytort-Hassan, Milapc nanata A text book of clinice pharmacy practice essential concepts and skills. 1st edition page no.38

the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education. **e) Prescribed medication order and communication skills** Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.		
Unit IV **a) Budget preparation and implementation** Budget preparation and implementation **b) Clinical Pharmacy** Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern. **c) Over the counter (OTC) sales** Introduction and sale of over the counter, and Rational use of common over the counter medications.	**8**	a)William.E.Hassan Hospital pharmacy, 5th edition, chapter 8, page no. 184. b)Parthasarathi G, Kann Nytort-Hansen, Kilap C Nahata. A text book of clinical pharmacy practice essential concepts and skills, 1st edition, page no. 140
Unit V **a) Drug store management and inventory control** Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure **b) Investigational use of drugs** Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.	**7**	Merchant S.H.and Dr.J.S.Quadry, A textbook of hospital pharmacy, 4th edition page no. 80. William.E.Hassan Hospital pharmacy, 5th edition, chapter 8, page no. 160. b)Parthasarathi G, Kann Nytort-Hansen, Kilap C Nahata. A text book of clinical pharmacy practice essential concepts and skills, 1st edition, page no. 140

c) Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis		

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of Clinical Pharmacy Practice- essential concepts and skills,* 1st ed. Chennai: Orient Longman Private Limited; 2004.
3. William E. Hassan. *Hospital pharmacy*, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications; 2008.
5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society of Health System Pharmacists Inc; 2009.
6. Parmar N.S. *Health Education and Community Pharmacy,* 18th ed. India: CBS Publishers & Distributers; 2008.

Journals:

1. Therapeutic drug monitoring. ISSN: 0163-4356
2. Journal of pharmacy practice. ISSN : 0974-8326
3. American journal of health system pharmacy. ISSN: 1535-2900 (online)
4. Pharmacy times (Monthly magazine)

BP 704 T

BP704T-NOVEL DRUG DELIVERY SYSTEMS
(Theory) 45 Hours

Scope: This subject is designed to impart basic knowledge on the area of novel drug delivery systems.

Objectives: Upon completion of the course student shall be able

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

Course Outcomes :

C704.1	To understand and rationalize fundamentals and polymers used in the design of controlled drug delivery systems.
C704.2	To outline the concepts of formulation and evaluation of oral, mycosal and implantable drug delivery system.
C704.3	To develop and study oral, mycosal, dermal, pulmonary and Nasal drug delivery systems over comational dosage forms for prolonged action intended for.
C704.4	Toillustrate the principles and fundamentals of drug forgetting in the design of site spain drug delivery system.
C704.5	To study the importance of site specific olds or divices for ocular and intr uterine routes
C704.6	To predict the rate and maximize theroperitic compliance of site specific drug delivery systems by modifying comutional dosage forms.

Course content:

Chapter/Topic	Duration (hrs)	References
Unit-I **Controlled drug delivery systems**: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates.Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations **Polymers:** Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.	**10**	01.Robinson, J.R.Lee V H.L. controlled drug delivery system, marcel dekker inc., New York, Vol 20, 1992, Part I chapter-I, page No.3 to 241 02.Patrick J Sinko, martin's physical pharmacy and pharmaceutical sciences 8th editions, New Delhi, wolfers Kluwer 2011, Chapter-20, page 492-515

Unit-II **Microencapsulation:** Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications **Mucosal Drug Delivery system:** Introduction, Principles of bioadhesion/mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems **Implantable Drug Delivery Systems:**Introduction, advantages and disadvantages, concept of implantsand osmotic pump	**10**	01.S.P Vyas and R K khar, Targetted and controlled drug delivery, Novol carriers system 1st edition, New Delhi, CBS publications, 2008, chapter-11, page. 417 to 451. 02.Y.Madhusudan Rao, V.Jithan Advances in drug delivery 1st edition, Hyderabad, Pharma Med Press 2012, Vol.II, Chapter 1 page. 185 to 214. 03. Robinson J R Lee VHL controlled drug delivery: fundamentals and applications 2nd edition, new Yark. Informa Health care 2009, Vol20, chapter12, page 523 - 554
Unit-III **Transdermal Drug Delivery Systems:** Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches **Gastroretentive drug delivery systems:** Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications **Nasopulmonary drug delivery system:** Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers	**10**	01.Robinson J R Lee V H L controlled drug delivery fundamentals and applications 2nd edition informa healthcare, New Yark 2009 Vol. 20, chapter-12, page.523-544. 02.N.K.Jain, Progess in controlled and Novel Drug delivery systems 1st edition, New Delhi, CBS publishers and distributers 2005, chapter-4, page 76-97. 03. Shoba Rani, R.Hiremath Text book of Industrial Pharmacy. Drug delivery systems and cosmetic and herbal drug technology, Chennai, orient long man pvt ltd, chapter-5 to 52.

Unit-IV **Targeted drug Delivery:** Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications	**08**	S.P.vyas and R.K.Khar Targetted and controlled Drug Delivery, Novel corrier system, 1st edition, New Delhi, CBS publicators-2008, Chapter 5, 6, 9, page 173-331.
Unit-V **Ocular Drug Delivery Systems:** Introduction, intra ocular barriers and methods to overcome – Preliminary study, ocular formulations and ocuserts **Intrauterine Drug Delivery Systems:** Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications	**07**	01.N.K.Jain, Controlled and novel ldrug delivery, 1st edition New Delhi, CBS publishers and distributers 2004, Chapter-4, page-83-98. 02.Yie.w.chair, Novel drug delivery system IInd edition, Vol.50, New yark, Markers Dekker inc. 2005.

Recommended Books: (Latest Editions)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Journals

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

BP 705 P

BP705P-INSTRUMENTAL METHODS OF ANALYSIS
(Practical) 4 Hours/Week

Course Outcomes :

C705.1	To recall the principle involved in spectroscopy and importance of absorption maximum in the estimation of organic compounds.
C705.2	To experiment with selected drugs by UV, Visible spectroscopy and flourimetry.
C705.3	To estimate the amount of sodium and potassium ions by flame photometry
C705.4	To characterize and quantify the organic compounds/amino acids/plant pigments by using various chromatographic and spectroscopical techniques.
C705.5	To analyze the various organic compounds using nepheloturbidimetry.
C705.6	To maximize the knowledge on integration and interpretation of chromatograms and spectra.

Course content:

S. No.	Name of the Experiment	Duration (Hrs)	References
1	Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds		1. Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005,Exp.No:1,Pg.15. 2.Practical Pharmaceutical Chemistry, A.H.Beckett and J.B. Stenlake, part-II fourth edition. CBS, Chapter No: 07, P.No: 327.
2	Estimation of dextrose by colorimetry		1. Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005,Exp.No :6 Pg.26. 2. Elementary organic spectroscopy, Y.R.Sharma, 14th edition, S.Chand, Chapter No: 02, P.No: 52.
3	Estimation of sulfanilamide by colorimetry		Dr.A.V.Kasture, Dr.Mahadik, pharmaceutical Analysis vol-II, 19th edition, Chapter No: 20, P.No: -183.
4	Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy		A.H.Beckett and J.B. Stenlake, Practical Pharmaceutical Chemistry, part-II fourth edition, CBS Chapter No: 07, P.No: 284

5	Assay of paracetamol by UV- Spectrophotometry		Indian Pharmacopeia, Government of India, Ministry of health and family welfare, the Indian Pharmacopoeia Commission, Ghaziabad, 1985, Vol-I, 3rd edition, P.No: 359.
6	Estimation of quinine sulfate by fluorimetry		1. Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005, Exp.No :10 Pg.40. 2.A.H.Beckett and J.B. Stenlake, Practical Pharmaceutical Chemistry, part-II fourth edition, CBS Chapter No:09, P.No: 369,372
7	Study of quenching of fluorescence		1. Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005,Exp.No :10 Pg.42. 2.A.H.Beckett and J.B. Stenlake, Practical Pharmaceutical Chemistry, part-II fourth edition,CBS Chapter No: 09, P.No: 372
8	Determination of sodium by flame photometry		1. Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005,Exp.No :13 Pg.48. 2.A.V.Kasture, Mahadik, Pharmaceutical Analysis vol-II, 19th edition, S.Chand, Chapter No: 23, P.No: 203
9	Determination of potassium by flame photometry		1. Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005,Exp.No :13 Pg.48. 2.A.V.Kasture, Mahadik, Pharmaceutical Analysis vol-II, 19th edition, S Chand Chapter No: 23, P.No: 203
10	Determination of chlorides and sulphates by nephelo turbidometry		1. Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005,Exp.No :9 Pg.36.

11	Separation of amino acids by paper chromatography		1. Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005,Exp.No :24 (A) Pg.72.
12	Separation of sugars by thin layer chromatography		Laboratory hand book of instrumental drug analysis, B.G.Nagavi, 3rd Edition, Vallabh Prakasham Publi-cations,2005,Exp.No:25,Pg.76.
13	Separation of plant pigments by column chromatography		Laboratory hand book of instrumental drug analysis, B.E.Nagoji, 3rd Edition, Vallabh Prakasham Publications, 2005, Exp. No : 24 (B). Pg.NO.74
14	Demonstration experiment on HPLC		1.Indian Pharmacopeia, Government of India, Ministry of health and family welfare, the Indian Pharmacopoeia Commi-ssion, Ghaziabad, 2018,Vol-II & III, 8th edition, P.No: 1145, 1621, 1901 and 2853. 2. Siarhei V. Charapitsa, Direct Determination of Volatile Compounds in Spirit Drinks by Gas Chromatography, *J. Agric. Food Chem., 2013,61* (12), P.No: 2950–2956. 3. Indian Pharmacopeia, Government of India, Ministry of health and family welfare, the Indian Pharmacopoeia Commission, Ghaziabad, 2018,Vol-II , 8th edition, P.No: 1901 and 1994.
15	Demonstration experiment on Gas Chromatography		

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy byWilliam Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

IV B.PHARMACY
8th SEMESTER

BP 801 T

BP801T-BIOSTATISITCS AND RESEARCH METHODOLOGY (Theory)
45 Hours

Scope: To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel**.**

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

- Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)
- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems**.**

Course Outcomes :

CB801.1	To understand the basic aspects of statistics such as central tendency, dispersion and correlation.
CB801.2	To make use of regression and probability while analyzing data by statistical methods.
CB801.3	To explain the need of research, research designs and their applications and to explain methodological designs.
CB801.4	To assess the need of regression modeling and to build up the ability to use various statistical problems.
CB801.5	To elaborate design and analysis of experiments and response surface methodology.
CB801.6	To build the ability to perform various parametric and non parametric statistical tests and to draw graphs and plots based on type of data.

Course content:

Chapter/Topic	Duration (hrs)	References
Unit-I **Introduction:** Statistics, Biostatistics, Frequency distribution **Measures of central tendency**: Mean, Median, Mode- Pharmaceutical examples **Measures of dispersion**: Dispersion, Range, standard deviation, Pharmaceutical problems **Correlation**: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples	**10**	1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork. 2. Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha

Unit-II **Regression:** Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– Pharmaceutical Examples **Probability:**Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties – problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples **Parametric test**: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference	**10**	1.Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
Unit-III **Non Parametric tests:** Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test **Introduction to Research:** Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism **Graphs:** Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph **Designing the methodology:** Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.	**10**	1.Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
Unit-IV Blocking and confounding system for Two-level factorials **Regression modeling:** Hypothesis testing in Simple and Multiple regressionmodels **Introduction to Practical components of Industrial and Clinical Trials Problems**:	**08**	1.Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork. 2.Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha

Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach		
Unit-V **Design and Analysis of experiments:** **Factorial Design:** Definition, 22, 23 design. Advantage of factorial design **Response Surface methodology**: Central composite design, Historical design, Optimization Techniques	**07**	1.Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam, 2.Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

BP 802 T

BP802T-SOCIAL AND PREVENTIVE PHARMACY

Hours: 45

Scope:

The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Objectives:

After the successful completion of this course, the student shall be able to:

- Acquire high consciousness/realization of current issuesrelated to health and pharmaceutical problems within the country and worldwide.
- Have a critical way of thinking based on current healthcare development.
- Evaluate alternative ways of solving problems related tohealth and pharmaceutical issues

Course Outcomes :

C802.1	To understand the concept of health and health education.
C802.2	To create awareness about various preventive measures of stated communicable and non communicable diseases.
C802.3	To apply the knowledge of national health programmes mentioned in real world to serve the society.
C802.4	To elaborate various vaccines under national immunization programme and their schedule.
C802.5	To demonstrate the impact of socio-cultural factors and urbanization on health.
C802.6	To evaluate the health and pharmacy related problems in societal perspective.

Course content:

Chapter/Topic	Duration (hrs)	References
Unit I **Concept of health and disease:** Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick. **Social and health education:** Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention. **Sociology and health:** Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health **Hygiene and health:** personal hygiene and health care; avoidable habits	**10**	Park's Text book of Preventive and Social Medicine-K.Park, 23rd edition-Pg.No.13. Park's text book of Preventive and Social Medicine-K.Park, 23rd edition, Pg.No.608. Park's text book of Preventive and Social Medicine, K.Park, 23rd edition, Pg.No.668

Unit II **Preventive medicine:** General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse	**10**	Park's text book of Preventive and Social Medicine, K.Park, 23rd edition, Pg.No.143.
Unit III **National health programs, its objectives, functioning and outcome of the following:** HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.	**10**	Park's text book of Preventive and Social Medicine, K.Park, 23rd edition, Pg.No.414
Unit IV National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program	**08**	Park's text book of Preventive and Social Medicine, K.Park, 23rd edition, Pg.No.414, 454, 473, 516, 919
Unit V Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.	**07**	Park's text book of Preventive and Social Medicine, K.Park, 23rd edition, Pg.No.445, 904.

Recommended Books (Latest edition)*:*

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

BP 803 ET

BP803ET-PHARMA MARKETING MANAGEMENT
(Theory) 45 Hours

Scope: The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.

Course Objective: The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

Course Outcomes :

C803.1	To understand different concepts of marketing.
C803.2	To identify marketing mix for pharmaceutical products.
C803.3	To classify different types of sales promotion.
C803.4	To examine pharmaceutical marketing channels.
C803.5	To compare pricing of the pharmaceutical products.
C803.6	To adapt to emerging concepts of marketing.

Course content:

Chapter / Topic	Duration (hrs)	References
Unit I **Marketing:** Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior. **Pharmaceutical market:** Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting.Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist.Analyzing the Market; Role of market research.	**10**	1.Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi 2. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill 3. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT –Excel series) Excel Publications.

Unit II **Product decision:** Classification, product line and product mix decisions, product life cycle,product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.	**10**	1.Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi 2. Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi. 3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill 5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
Unit III **Promotion:** Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.	**10**	1. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India 2. Shanker, Ravi: Service Marketing, Excell Books, New Delhi 3.Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.
Unit IV **Pharmaceutical marketing channels:** Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management. **Professional sales representative (PSR):** Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.	**10**	1.Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi 2.Walker, Boyd and Larreche: Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi. 3. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition) 4. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

Unit V **Pricing:** Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order)and NPPA (National Pharmaceutical Pricing Authority). **Emerging concepts in marketing:** Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.	**10**	1.Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi 3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill 6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt: Global Perspective, IndianContext,Macmilan India, New Delhi. 8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

BP 804 ET

BP804ET-PHARMACEUTICAL REGULATORY SCIENCE
(Theory) 45Hours

Scope: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia,UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

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

1. Know about the process of drug discovery and development
2. Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
3. Know the regulatory approval process and their registration in Indian and international markets

Course Outcomes :

C804.1	To recall the concepts of Drug discovery, development process, clinical studies and generic drug product development.
C804.2	To perceive the regulatory approval process and timelines for IND, NDA and ANDA and to know about changes to an approved NDA/ANDA.
C804.3	To familiar with Regulatory authorities and agencies like India, USA, Europe, Australia, Japan and Canada.
C804.4	To know the regulatory registration process of Indian drugs in overseas market which include to understand about technical documents like DMF, CTD, eCTD and ACTD.
C804.5	To assimilate the process of clinical trials and pharmacovigilance as well as to understand obligations of GCP in clinical trials.
C804.6	To understand the concepts of Regulatory science in pharmaceutical industry as well as to make use of regulatory guidelines, laws, acts, orange and purple book.

Course content:

Chapter/Topic	Duration (hrs)	References
Unit I **New Drug Discovery and development** Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.	**10**	1.Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan. 2.New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.

		03.FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
Unit II **Regulatory Approval Process** Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA. **Regulatory authorities and agencies** Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)	**10**	01.The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers. 02.New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol.190. 03)FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
Unit III **Registration of Indian drug product in overseas market** Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD)research.	**10**	1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan. 2. Guidebook for drug regulatory submissions / SandyWeinberg. By John Wiley & Sons. Inc. www.cdsco.gov.in, www.ich.org/produts/guidelines
Unit IV **Clinical trials** Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical	**08**	01.Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams

trials, Pharmacovigilance - safetymonitoring in clinical trials		02.Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
Unit V **Regulatory Concepts** Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book	**07**	01.FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / SandyWeinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9. Drugs: From Discovery to Approval, Second Edition By Rick Ng

BP 805 ET

BP805T-PHARMACOVIGILANCE
(Theory) 45 hours

Scope: This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.

Objectives:

At completion of this paper it is expected that students will be able to (know, do, and appreciate):

1. Why drug safety monitoring is important?
2. History and development of pharmacovigilance
3. National and international scenario of pharmacovigilance
4. Dictionaries, coding and terminologies used in pharmacovigilance
5. Detection of new adverse drug reactions and their assessment
6. International standards for classification of diseases and drugs
7. Adverse drug reaction reporting systems and communication in pharmacovigilance
8. Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle
9. Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
10. Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
11. ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning
12. CIOMS requirements for ADR reporting
13. Writing case narratives of adverse events and their quality.

Course Outcomes :

C805.1	To understand the history of pharmacoivigilance, adverse drug reactions and basic terminologies in Pharmacovigilance.
C805.2	To make use of various drug disease classifications, drug dictionaries and drug information resources in pharmacovigilance.
C805.3	To explain various methods of pharmacovigilance and communication process during ADR reporting.
C805.4	To appraise safety data generation and ICH guidelines in pharmacovigilance.
C805.5	To evaluate drug and vaccine safety in special population and to appraise the process of haemovigilance and materiovigilance.
C805.6	To build the ability to report adverse drug reactions through various ADR reporting forms.

Course Content

Chapter/Topic	Duration (hrs)	References
Unit I **Introduction to Pharmacovigilance** • History and development of Pharmacovigilance • Importance of safety monitoring of Medicine • WHO international drug monitoring programme • Pharmacovigilance Program of India(PvPI) **Introduction to adverse drug reactions** • Definitions and classification of ADRs • Detection and reporting • Methods in Causality assessment • Severity and seriousness assessment • Predictability and preventability assessment • Management of adverse drug reactions **Basic terminologies used in pharmacovigilance** • Terminologies of adverse medication related events • Regulatory terminologies	**10**	1. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers. 2. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
Unit II **Drug and disease classification** • Anatomical, therapeutic and chemical classification of drugs • International classification of diseases • Daily defined doses • International Non proprietary Names for drugs **Drug dictionaries and coding in pharmacovigilance** • WHO adverse reaction terminologies • MedDRA and Standardised MedDRA queries • WHO drug dictionary • Eudravigilance medicinal product dictionary	**10**	1. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers. 2. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers. 3. A Textbook of Clinical Pharmacy Practice – Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen,Milap C. Nahata

Information resources in pharmacovigilance • Basic drug information resources • Specialised resources for ADRs **Establishing pharmacovigilance programme** • Establishing in a hospital • Establishment & operation of drug safety department in industry • Contract Research Organisations (CROs) Establishing a national programme		4. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
Unit III **Vaccine safety surveillance** • Vaccine Pharmacovigilance • Vaccination failure • Adverse events following immunization **Pharmacovigilance methods** • Passive surveillance – Spontaneous reports and case series • Stimulated reporting • Active surveillance – Sentinel sites, drug event monitoring and registries • Comparative observational studies – Cross sectional study, case control study and cohort study • Targeted clinical investigations **Communication in pharmacovigilance** • Effective communication in Pharmacovigilance • Communication in Drug Safety Crisis management • Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media	**10**	1. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers. 2. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers. 3. A Textbook of Clinical Pharmacy Practice – Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen,Milap C. Nahata 4. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna 5.http://www.who.int/vaccine_safety/en/
Unit IV **Safety data generation** • Pre clinical phase • Clinical phase • Post approval phase (PMS)	**08**	1. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers. 2. http://www.ich.org/

ICH Guidelines for Pharmacovigilance • Organization and objectives of ICH • Expedited reporting • Individual case safety reports • Periodic safety update reports • Post approval expedited reporting • Pharmacovigilance planning • Good clinical practice in pharmacovigilance studies		
Unit V **Pharmacogenomics of adverse drug reactions** • Genetics related ADR with example focusing PK parameters. **Drug safety evaluation in special population** • Paediatrics • Pregnancy and lactation • Geriatrics **CIOMS** • CIOMS Working Groups • CIOMS Form **CDSCO (India) and Pharmacovigilance** • D&C Act and Schedule Y • Differences in Indian and global pharmacovigilance requirements	**07**	1. Mann's Pharma-covigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers. 2. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers. 3.http://www.cioms.ch 4. http://cdsco.nic.in

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert, Jones & Bartlett Publishers.
7. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy,Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen,Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal
11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna
12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1= 7347 & mn2 = 7259&mn 3=7297
13. http://www.ich.org/
14. http://www.cioms.ch/
15. http://cdsco.nic.in/
16. http://www.who.int/vaccine_safety/en/
17. http://www.ipc.gov.in/PvPI/pv_home.html

BP 806 ET

BP806ET-QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

Scope: In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

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

1. know WHO guidelines for quality control of herbal drugs
2. know Quality assurance in herbal drug industry
3. know the regulatory approval process and their registration in Indian and international markets
4. appreciate EU and ICH guidelines for quality control of herbal drugs

Course Outcomes :

C806.1	To recall the WHO guidelines for the quality control of herbal drugs.
C806.2	To illustrate and outline the quality assurance in traditional system of medicine including CGMP, GAP, GMP and GLP.
C806.3	To compare the quality control parameters of drugs according to European union and ICH guidelines.
C806.4	To make use of research guidelines for evaluation of safety and effiency of herbal medicine.
C806.5	To apply the knowledge of chromatography in standardization of herbal drugs and to perform the stability studies.
C806.6	To improve the knowledge on regulatory issues for herbal medicine including GMP, WHO guidelines on safety monitoring of herbal medicine in Pharmacovigilance.

Course Content :

Chapter / Topic	Duration (hrs)	References
Unit I Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use	**10**	01.Pharmacognosy and phytochemistry, A.comprehensive approach, S.L.Deore, S.S.Khadabadi, pharma Med Press. 02.Phamacognosy by Trease and evans, 16th edition.
Unit II **Quality assurance in herbal drug industry** of cGMP, GAP, GMP and GLP in traditional system of medicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants.	**10**	01.Quality control of herbal drugs, an approach to evaluation of botanicals by Dr.Pulok, K.Mukherjee, Business horizons publishers, New Delhi, India, 2002. 01.Pharmacognosy and phytochemistry, A.comprehensive

		approach, S.L.Deore, S.S.Khadabadi, pharma Med Press. 03.WHO guidelines on Good Agricultural and collection practices (GACP) for medicinal plants. WHO geneva, 2004.
Unit III EU and ICH guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines	**10**	01.EMEA guidelines on quality of Herbal medicinal products/Traditional Medicinal products/Traditional Medicinal products. 02.ICH guidelines for quality control of herbal drugs.
Unit IV Stability testing of herbal medicines.Application of various chromatographic techniques in standardization of herbal products. Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.	**08**	01.Pharmacognosy and phytochemistry, A comprehensive approach, S.L.Deore, S.S.Khadabadi, Pharma Med Press. 02.Pharmacognosy by C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali Prakashan publications.
Unit V Regulatory requirements for herbal medicines. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias. Role of chemical and biological markers in standardization of herbal products	**07**	01.Pharmacognosy and phytochemistry, A comprehensive approach, S.L.Dcore, S.S.Khadabadi, Pharma Med Press. 01.EMEA guidelines on quality of Herbal medicinal products/Traditional Medicinal products/Traditional Medicinal products. 03.WHO quality control methods for medicinal plant materials, WHO, Geneva, 1999.

Recommended Books: (Latest Editions

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub., 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials,World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

BP 807 ET

BP807ET-COMPUTER AIDED DRUG DESIGN
(Theory) 45 Hours

Scope: This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

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

- Design and discovery of lead molecules
- The role of drug design in drug discovery process
- The concept of QSAR and docking
- Various strategies to develop new drug like molecules.
- The design of new drug molecules using molecular modeling software

Course Outcomes :

C807.1	To recall the approaches in drug discovery, drug development, lead discovery based on metabolism and clinical observation and also analog based drug design
C807.2	To explain the development, approaches of QSAR, importance and determination of physicochemical parameters
C807.3	To make use of molecular modeling and virtual screening techniques
C807.4	To apply the molecular docking techniques to examine the binding interactions of ligand with molecular targets
C807.5	To explain the applications of bioinformatics, chemo informatics, ADME databases, chemical, biochemical and pharmaceutical databases relevant to drug design
C807.6	To discuss the conformational analysis of molecules using molecular and quantum mechanics approach and also determine the global conformational minima

Course Content:

Chapter / Topic	Duration (hrs)	References
UNIT-I **Introduction to Drug Discovery and Development** Stages of drug discovery and development **Lead discovery and Analog Based Drug Design** Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.	**10**	1. An introduction to medicinal chemistry, Graham L. Patrick, 3rd Edition, Oxford university, 2006, Ch.10 & 12, pg. 213, 250 2. The organic chemistry of drug design and drug action, Richard B.Silverman, 2nd Edition, Academic press, Elsevier, 2004, Ch.2, pg. 07

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies		3. Medicinal chemistry, Rama Rao Nadendla, 2nd edition, PharmaMed press, 2013, Ch.03, pg. 36
UNIT-II **Quantitative Structure Activity Relationship (QSAR)** SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.	**10**	1. Medicinal chemistry, Rama Rao Nadendla, 2nd edition, PharmaMed press, 2013, Ch.04, pg. 40 2. The organic chemistry of drug design and drug action, Richard B.Silverman, 2nd Edition, Academic press, Elsevier, 2004, Ch.2, pg. 66 3. An introduction to medicinal chemistry, Graham L. Patrick, 3rd Edition, Oxford university, 2006, Ch.13, pg. 271
UNIT-III **Molecular Modeling and virtual screening techniques** **Virtual Screening techniques:** Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening, **Molecular docking**: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design.	**10**	1. Wilson and Gisvold's textbook of organic, medicinal and pharmaceutical chemistry, John H. Block, John M.Beale, 11th edition, 2004, Lippincott williams & wilkins, Ch.28, pg. 919 2. An introduction to medicinal chemistry, Graham L. Patrick, 3rd edition, Oxford university, 2006, Ch.13, pg. 271
UNIT-IV **Informatics & Methods in drug design** Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.	**08**	1. Wilson and Gisvold's textbook of organic, medicinal and pharmaceutical chemistry, John H. Block, John M.Beale, 11th edition, 2004, Lippincott williams & wilkins, Ch.28, pg. 919 2. Bioinformatics,

		concepts, skills and applications, S.C. Rastogi, 2nd edition, 2017, CBS publishers, Ch.01, pg. 01 3. Applied Biopharmaceutics and pharmacokinetics, Leon shargel, 5th edition, McGraw Hill, 2005, Appendix B, pg.781
UNIT-V **Molecular Modeling:** Introduction to molecular mechanics and quantum mechanics.Energy Minimization methods and Conformational Analysis, global conformational minima determination.	**07**	1. Wilson and Gisvold's textbook of organic, medicinal and pharmaceutical chemistry, John H. Block, John M.Beale, 11th edition, 2004, Lippincott williams & wilkins, Ch.28, pg. 919 2. Foye's principles of medicinal chemistry, Thomas L. Lemke, David A. Williams, 6th edition, Lippincott williams & wilkins, 2008, Ch.3, pg. 54-84

BP 808 ET

BP808ET-CELL AND MOLECULAR BIOLOGY (Elective subject)
45 Hours

Scope:

- Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function.
- This is done both on a microscopic and molecular level.
- Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organismssuch as humans, plants, and sponges.

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

- Summarize cell and molecular biology history.
- Summarize cellular functioning and composition.
- Describe the chemical foundations of cell biology.
- Summarize the DNA properties of cell biology.
- Describe protein structure and function.
- Describe cellular membrane structure and function.
- Describe basic molecular genetic mechanisms.

Course Outcomes :

C808.1	To relate the basic structure, properties of cells (prokaryotic and eukaryotic) and cell membranes / cellular reproduction.
C808.2	To illustrate DNA structure and functioning, RNA and protein synthesis (transcription/translation).
C808.3	To organize protein structure, pathways, cellular processes and significance of protein synthesis.
C808.4	To distinguish the science of genetics, transgenics, genomic and cell cycle analysis.
C808.5	To interpret mitosis / meiosis, cellular activities and checkpoints.
C808.6	To elaborate how cell communication occur and discuss mechanisms of receptors for cell signaling/signaling pathways/Protein kinase

Course content:

Chapter/Topic	Duration (hrs)	References
Unit I a) Cell and Molecular Biology: Definitions theory and basics and Applications. b) Cell and Molecular Biology: History and Summation. c) Properties of cells and cell membrane. d) Prokaryotic versus Eukaryotic e) Cellular Reproduction f) Chemical Foundations – an	**10 Hrs**	1. Microbiology – Gerarard. J.Toratora, 9th edition; Unit-4. 2. Microbiology – Pelczar, 5th edition, Chapter-7.

Introduction and Reactions (Types)		
Unit II a) DNA and the Flow of Molecular Information b) DNA Functioning c) DNA and RNA d) Types of RNA e) Transcription and Translation		1. Prescott's-Microbiology, 8th edition, Part-4, Unit-12. 2. Microbiology – Gerarard.J.Toratora, 9th edition; Unit-2.
Unit III a) Proteins: Defined and Amino Acids b) Protein Structure c) Regularities in Protein Pathways d) Cellular Processes e) Positive Control and significance of Protein Synthesis	**10 Hrs**	1. Biochemistry and microbiology – Nilliam.H.Elliot 2nd edition, Part:2&22
Unit IV a) Science of Genetics b) Transgenics and Genomic Analysis c) Cell Cycle analysis d) Mitosis and Meiosis e) Cellular Activities and Checkpoints		1. Prescott's-Microbiology, 8th edition, Part-4, Unit-16. 2. Biochemistry, U.Satyanarayana, 4th edition, Section-5, 3. Genomics, protepmics, functional and computational aspects – Sandor suhai, 2nd edition, Unit-11
Unit V a) Cell Signals: Introduction b) Receptors for Cell Signals c) Signaling Pathways: Overview d) Misregulation of Signaling Pathways e) Protein-Kinases: Functioning	**07 Hrs**	1. Biochemistry, U.Satyanarayana, 4th edition, Section-5

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. Peppler: Microbial Technology.
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.

BP 809 ET

BP809ET-COSMETIC SCIENCE

(Theory) 45Hours

Course Outcomes :

C809.1	To remember classification and historical evolution of cosmetics, cosmeceutical products, cosmetic excipients and recall the basic structure, functions and common problems associated with skin, hair and oral cavity.
C809.2	To understand the principles of formulation and building blocks of various skin care products and hair care products.
C809.3	To describe the role of herbs in cosmetics and analytical methods for cosmetics.
C809.4	To evaluate various cosmetics using analytical instruments.
C809.5	To apply the knowledge gained and develop cosmetics to solve problems associated with skin, hair and scalp.

Course content:

Chapter / Topic	Duration (hrs)	References
UNIT I Classification of cosmetic and cosmeceutical products Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs **Cosmetic excipients:** Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application. **Skin:** Basic structure and function of skin. **Hair:** Basic structure of hair. Hair growth cycle. **Oral Cavity:** Common problems associated with teeth and gums**.**	**10**	1.P.P.Sharma, Cosmetics -Formulation, manufacturing & quality control, fourth edition, Vandna Publications Pvt.Ltd., Chapter 1, Page No. 3-18. 2. B.M. Mithal, R.N. Saha. A Handbook of Cosmetics. Vallabh Prakashan, Chapter 1, Page No. 1-10. 3. Sanju Nanda, Arun Nanda and Roop.K.Khar. Cosmetic Technology, Birla Publications Pvt. Ltd., Delhi, Chapter 12, Page No. 238-242.
UNIT II **Principles of formulation and building blocks of skin care products:** Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmeceuticals. **Antiperspirants & deodorants**-Actives & mechanism of action.	**10**	1. Poucher's Perfumes, Cosmetics and Soaps. Edited by Hilda Butler, Springer International Edition, 10th Edition, Chapter 7, Page No. 217-277. 2. Sanju Nanda, Arun Nanda and Roop.K.Khar. Cosmetic Technology, Birla Publications Pvt.

Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo, Hair oil. Chemistry and formulation of Para-phylene diamine based hair dyes. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth, Teeth whitening, Mouthwash.		Ltd., Delhi, Chapter 12, Page No. 250-269. 3. Poucher's Perfumes, Cosmetics and Soaps. Edited by Hilda Butler., Springer International Edition, 10th Edition, Chapter 14, Page No. 413-416. 4. Sanju Nanda, Arun Nanda and Roop.K.Khar. Cosmetic Technology, Birla Publications Pvt. Ltd., Delhi, Chapter 16, Page No. 354-378.
UNIT III Sun protection, Classification of Sunscreens and SPF. **Role of herbs in cosmetics:** Skin care: Aloe and turmeric. Hair care: Henna and amla. Oral care: Neem and clove. **Analytical cosmetics:** BIS specification and analytical methods for shampoo, skincream and toothpaste**.**	**10**	1. Shobha Rani R. Hiremath. Text Book of Industrial Pharmacy. Orient Longman Pvt. Ltd., Chapter 21, Page No. 245-277. 2. Sanju Nanda, Arun Nanda and Roop.K.Khar. Cosmetic Technology, Birla Publications Pvt. Ltd., Delhi, Chapter 12, Page No. 285-301.
UNIT IV Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evaluation and skin benefits.	**08**	1. Poucher's Perfumes, Cosmetics and Soaps. Edited by Hilda Butler., Springer International Edition, 10th Edition, Chapter 17, Page No. 507-554.
UNIT V Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes. Cosmetic problems associated with skin: Blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants-Actives and mechanism of action.	**07**	1. Poucher's Perfumes, Cosmetics and Soaps. Edited by Hilda Butler., Springer International Edition, 10th Edition, Chapter 3, Page No. 69-100. 2. B.M.Mithal, R.N.Saha. A Handbook of Cosmetics. Vallabh Prakashan, Chapter 7, Page No. 108-109.

References

1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.

3) Text book of Cosmeticology by Sanju Nanda, Arun Nanda & Roop K. Khar, Birla Publications Pvt. Ltd.

BP 810 ET

BP810ET-PHARMACOLOGICAL SCREENING METHODS

45 Hours

Scope: This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.

Objectives

Upon completion of the course the student shall be able to,

- Appreciate the applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in preclinical research
- Appreciate and demonstrate the importance of biostatistics and researchmethodology
- Design and execute a research hypothesis independently

Course Outcomes :

C810.1	To recall the CPCSEA/OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals and to demonstrate different laboratory/transgenic/ mutant animals, various routes of administration, techniques of blood collection and euthanasia.
C810.2	To outline various preclinical screening models for diuretics, nootropics, antiasthmatics and drugs acting on CNS.
C810.3	To construct preclinical screening models for drugs acting on ANS, eye and local anesthetics.
C810.4	To analyze the preclinical screening models for drugs acting on CVS.
C810.5	To appraise the preclinical screening models for drugs like antiulcer, antidiabetic and anticancer agents.
C810.6	To compile research methodology and biostatistics

Course content:

Chapter/Topic	Duration (hrs)	References
Unit –I **Laboratory Animals:** Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and	**08 Hrs**	1. Compendium of CPCSEA, 2018; 36-96. 2. OECD guidelines for testing of chemicals 3. Screening methods in pharmacology – N.S.Parmar; 1st edition; Expt No.:3 & 4 4. Introduction to experimental pharmacology – Dr.Umabhandari; 1st edition, Expt.No:2 5. Drug discovery and evaluation – H.Gerard

euthanasia.		Vogel,2nd edition, Chapter-Q.
Unit –II **Preclinical screening models** a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study. b. **Study of screening animal models for** Diuretics, nootropics, anti-Parkinson's,antiasthmatics, **Preclinical screening models:** for CNS activity- analgesic, antipyretic,anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease	**10 Hrs**	1. Drug screening methods – S.K.Gupta, 2nd edition, Expt.No.26,32,44. 2. Screening methods in pharmacology – N.S.Parmar; 1st edition; Expt No.:5,9 – 11.
Unit –III **Preclinical screening models:** for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics	**10 Hrs**	1 Drug screening methods – S.K.Gupta, 2nd edition, Expt.No.22-24. 2 Screening methods in pharmacology – N.S.Parmar; 1st edition; Expt No.:6, 16.
Unit –IV **Preclinical screening models:** for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.	**12 Hrs**	1 Drug screening methods – S.K.Gupta, 2ndedition, Expt.No.10, 16,18-20,35,40. 2 Screening methods in pharmacology – N.S.Parmar; 1st edition; Expt No.:7,8,10,11,13,14.

Unit –V **Research methodology and Bio-statistics** Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data	**05 Hrs**	1 Research methodology concepts and cases – Deepak Chawla, 2nd edition. 2 Methods in biostatistics – B.K.Mahajan, 6th edition.

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-byM.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K. Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard

BP 811 ET

BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES

45 Hours

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

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

- understand the advanced instruments used and its applications in drug analysis
- understand the chromatographic separation and analysis of drugs.
- understand the calibration of various analytical instruments
- know analysis of drugs using various analytical instruments.

Course Outcomes :

C811.1	To understand the principle and procedure involved in selected instrumental analytical techniques (spectroscopy,chromatography and thermal methods)
C811.2	To gain knowledge on interaction of EMR with matter and to build the analytical understanding at the level of atom, group and molecular structure of organic and inorganic compounds with different functional groups and their applications in pharmacy.
C811.3	To maximize knowledge on characterization and estimation of drugs by spectroscopicaland thermal techniques
C811.4	To simplify the importance of calibration and validation of analytical instruments as per ICH and USFDA guidelines.
C811.5	To elaborate various principles and procedure employed in radio immuno assay and extraction techniques.
C811.6	To detail the principle, instrumentation and applications of hyphenated techniques.

Course Content:

Chapter / Topic	Duration (hrs)	References
UNIT-I **Nuclear Magnetic Resonance spectroscopy** Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications **Mass Spectrometry**- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers- Time of flight and Quadrupole, instrumentation, applications	**10**	1. Instrumental methods of chemical analysis Gurdeep R.Chatwal, Sham K.Anand, 5th edition, Himalaya publishers, Chapter 2.185 & 2.272. 2. Instrumental Methods of Chemical Analysis by B.K Sharma, 1st Editio, Krishna Publications, 1972, Chapter No: 02, P.No: 13,15 &19

		3. Pharmaceutical Analysis by Kasture, Vol-II, Chapter 25 &26.
UNIT-II **Thermal Methods of Analysis**: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) **X-Ray Diffraction Methods:** Origin of X-rays, basic aspects of crystals, Xray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.	**10**	1. Instrumental methods of chemical analysis Gurdeep R.Chatwal, Sham K.Anand, 5th edition, Himalaya publishers, Chapter 2.701 & 2.303. 2. Instrumental Methods of Chemical Analysis by B.K Sharma, 1st Editio, Krishna Publications, 1972, Chapter No: 02, P.No: 8 &10 3. Pharmaceutical Analysis by Kasture, Vol-II, Chapter 28. 4. Instrumental methods of analysis- Willard, Merritt, Dean, Settle, 1st ed., CBS publishers & distributors Pvt. Ltd., 1986. Chapter. No: 13 25. 5. Practical Pharmaceutical chemistry- A.H. Beckett, J.B.Stenlake, 4th ed., CBS publishers & distributors Pvt. Ltd., 2007. Chapter. No: 3. 6. Instrumental analysis- Skoog, Holler, Crouch, 4th ed., Cengage learning India Pvt. Ltd., 2012. Chapter. No: 31.
UNIT-III **Calibration and validation-**as per ICH and USFDA guidelines **Calibration of following Instruments** Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC	**10**	1. Pharmaceutical Master validation plan by Syed Imtiaz haisder, st.Lucie press, chapter 9. 2. Calibration and Validation of HPLC, GC and UV-VIS Spectroscopy, IJCAS, 2014, 1(4), 27–34.

UNIT-IV **Radio immune assay:** Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay **Extraction techniques**:General principle and procedure involved in the solid phase extraction and liquid-liquid extraction	**08**	1.Pharmaceutical Analysis, part A by James W.Munson, International medical book distribution, Chapter 6. 2.Pharmaceutical Analysis by Kasture Vol-I, Chapter 13.
UNIT-V **Hyphenated techniques**-LC-MS/MS, GC-MS/MS, HPTLC-MS.	**07**	1.Practical Pharmaceutical Chemistry by A.H.Beckett & J.B.stenkale, 4th edition, part two, Chapter 12. 2.Tandem Techniques by R.P.W.Scott, Wiley Publications, Chapter 5,9.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy byWilliam Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

BP 812 ET

BP812ET-DIETARY SUPPLEMENTS AND NUTRACEUTICALS

No. of hours :3 Tutorial:1 Credit point:4

Scope :

This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Objective:

This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to :

1. Understand the need of supplements by the different group of people to maintain healthy life.
2. Understand the outcome of deficiencies in dietary supplements.
3. Appreciate the components in dietary supplements and the application.
4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

Course Outcomes :

C812.1	To define, classify and understand the functional foods, Nutraceuticals and dietary supplements.
C812.2	To remember the sources, chemical nature, medicinal uses and health benefits of Nutraceuticals and functional foods.
C812.3	To interprete the applications of phytochemicals as Nutraceuticals like sulfies, phytochemicals as Nutraceuticals like sulfides, polyphenolics, flavonoids, probiotics, Tocopherols, proteins, minerals etc.
C812.4	To examine (to identify the damaging reactions of free radicals on tepids, carbohydrates. Proteins and nucleic acids. Role of functional foods in various disease conditions.
C812.5	To analyse the role of dietary fibres and complex carbohydrates as functional food ingredients
C812.6	To discuss the regulatory aspects, adultration of dietary fibres and Nutraceuticals and their pharmacopoeal specifications.

Course Content:

Chapter/Topic	Duration (hrs)	References
UNIT I a.Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.	**07**	01. Advanced text book on food and nutrition. Vol-II by Dr.M.Swami-nadhan, The bengalore printing and publishing co. ltd. 02. Dietetics by Sri Lakshmi. 03. Role of dietary fibres and Nutraceuticals in preventing diseases by K.T.Agusti and P.Faizal, B.S.Publications.

b.Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community. c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds		
UNIT II Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin b) Sulfides: Diallyl sulfides, Allyl trisulfide. c) Polyphenolics: Reservetrol d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum f) Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans g) Tocopherols h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.	**15**	01.Pharmaceutical wealth of fruits, vegetables and spices by Irfan Ali Khan, Ukaaz publications. 02.Phytochemicals as Nutraceuticals by Ben Best http://www.benbest.com/neutraceut/phytochemicals/html. 03. Role of dietary fibres and Nutraceuticals in preventing diseases, K.T.Augusti, Pharma Med Press.
UNIT III a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids. b) Dietary fibres and complex carbohydrates as functional food ingredients.	**07**	01. Role of dietary fibres and Nutraceuticals in presenting diseases by K.T.Augusti, pharma med press.

UNIT IV a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing. b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α-Lipoic acid, melatonin Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole. c) Functional foods for chronic disease prevention	**10**	01.Prescription for nutritional healing by james F. Blash and Phyllis A.Balch 2nd edition, Avery publishing group, N.Y. 02. Role of dietary fibres and Nutraceuticals in presenting diseases by K.T.Augusti, pharma med press.
UNIT V a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.	**06**	01.www.fssai.gov.in 02.www.fola.gov/home 03. Advanced text book on food and nutrition, vol-II by Dr.M.Swami-nathan, The Bangalore printing and publishing co.ltd.,

References:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BSPunblication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery Publishing Group, NY (1997).
6. G. Gibson and C.williams Editors *2000 Functional foods* Woodhead Publ.Co.London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of Functional Foods* M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger

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Semester VIII – Elective course on Pharmaceutical Product Development

No of Hours: 3 Tutorial:1 Credit points:4

Course Outcomes :

C813.1	To recall the formulation development of different types of dosage forms
C813.2	To outline the role of different pharmaceutical excipients in product development
C813.3	To select the excipients for a specific drug products
C813.4	To classify different of packaging for the drug product and materials used for primary and secondary packaging.
C813.5	To choose optimization technique in the development of pharmaceutical drug product.
C813.6	To design the drug product by using principles of Quality by Design(QbD)

Course Content:

Chapter/Topic	Duration (hrs)	References
Unit-I Introduction to pharmaceutical product development, objectives, regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosage forms	**10**	01.N.K.Jain, pharmaceutical product development, first edition, CBS Publishers and distributors, New Delhi 2006, page No. 1-25.
Unit-II An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Solvents and solubilizers ii. Cyclodextrins and their applications iii. Non - ionic surfactants and their applications iv. Polyethylene glycols and sorbitols. v. Suspending and emulsifying agents vi. Semi solid excipients	**10**	01.Handbook of pharmaceutical excipients fifth edition 2006. Pharmaceutical press Raymond C Rowe. 02. Pharmaceutical dosage forms, dispress systems, volume-1, Herbert A.Liebermon, Marcel Dekker, Newyork, 2005, page No. 211 to 281, Volume-2, page No. 149-258
Unit-III An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Tablet and capsule excipients ii. Directly compressible vehicles	**10**	01. A.Lieberman, Pharmaceutical dosage forms, Tablets volume, second edition, marcel dekker, 1989, Page No. 75-245.

iii. Coat materials iv. Excipients in parenteral and aerosols products v. Excipients for formulation of NDDS Selection and application of excipients in pharmaceutical formulations with specific industrial applications		02.Handbook of pharmaceutical excipients fifth edition 2006. Pharmaceutical press Raymond C Rowe.
Unit-IV Optimization techniques in pharmaceutical product development.A study of various optimization techniques for pharmaceutical product development with specific examples.Optimization by factorial designs and their applications.A study of QbD and its application in pharmaceutical product development.	**08**	01.S.Banker, modern pharmaceutics, fourth edition, informa health care, Newyork, 2009, page No. 607-626. 02. S.Dorion, Pharmaceutical statistics, fifth edition, informa Health Cae, New York, 2010, Page No. 222-239
Unit-V Selection and quality control testing of packaging materials for pharmaceutical product development- regulatory considerations.	**07**	01.N.K.Jain, pharmaceutical product development, first edition, CBS publishere, New Delhi, 2006 chapter 11, Page No. 341-377 02.Micheal E Aullon, Pharmaceutics fourth edition, Elseveir Ltd., 2013, page No. 811 to 824

Recommended Books (Latest editions)

1. Pharmaceutical Statistics Practical and Clinical Applications by Stanford Bolton, CharlesBon; Marcel Dekker Inc.
2. Encyclopedia of Pharmaceutical Technology, edited by James swarbrick, Third Edition,Informa Healthcare publishers.
3. Pharmaceutical Dosage Forms, Tablets, Volume II, edited by Herbert A. Lieberman andLeon Lachman; Marcel Dekker, Inc.
4. The Theory and Practice of Industrial Pharmacy, Fourth Edition, edited by Roop kKhar, S P Vyas, Farhan J Ahmad, Gaurav K Jain; CBS Publishers and Distributors Pvt.Ltd. 2013.
5. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth Edition, edited by Patrick J. Sinko, BI Publications Pvt. Ltd.
6. Targeted and Controlled Drug Delivery, Novel Carrier Systems by S. P. Vyas and R. K.Khar, CBS Publishers and Distributors Pvt. Ltd, First Edition 2012.
7. Pharmaceutical Dosage Forms and Drug Delivery Systems, Loyd V. Allen Jr., Nicholas B.Popovich, Howard C. Ansel, 9th Ed. 40
8. Aulton's Pharmaceutics – The Design and Manufacture of Medicines, Michael E. Aulton,3rd Ed.
9. Remington – The Science and Practice of Pharmacy, 20th Ed.
10. Pharmaceutical Dosage Forms – Tablets Vol 1 to 3, A. Liberman, Leon Lachman and Joseph B. Schwartz
11. Pharmaceutical Dosage Forms – Disperse Systems Vol 1 to 3, H.A. Liberman, Martin, M.R and Gilbert S. Banker.
12. Pharmaceutical Dosage Forms – Parenteral Medication Vol 1 & 2, Kenneth E. Avis andH.A. Libermann.
13. Advanced Review Articles related to the topics.