BOMBAY COLLEGE OF PHARMACY

(AUTONOMOUS)

Detailed Syllabus for First Year B. Pharm. (2019-20)

Syllabus structure B.Pharm (First Year)

Course of study for Semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I–Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory	2	-	2
BP107P	Human Anatomy and Physiology –Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical	2	-	1
BP112RBP	Remedial Biology – Practical	2	-	1
Total		**32/34$/36#**	**4**	**27/29$/30#**

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

Course of study for Semester II

Course Code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory	3	-	3
BP206T	Environmental sciences – Theory	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical	2	-	1
Total		**32**	**4**	**29**

SEMESTER I

BP101T

HUMAN ANATOMY AND PHYSIOLOGY-I (Theory) 45 Hours

Course Objectives:

To impart fundamental knowledge on the anatomy, physiology and functions of the various systems of the human body.

Course Outcomes:

The learner should be able to:

1. Explain the gross morphology, structure and functions of various organs of the human body with respect to the levels of organisation and communication
2. Explain the various homeostatic mechanisms and their imbalances of the lymphatic, nervous and cardiovascular systems in relation to the knowledge of the pathophysiology of diseases.
3. Discuss the composition and functions of blood, explain the process of hemostasis and correlate the knowledge to haematological disorders.
4. Understand coordinated working pattern of different muscles and organs of each system.

Unit	Details	Hours
1	Introduction to human body • Definition and scope of anatomy and physiology • Levels of structural organization and body systems • Basic life processes, homeostasis	1
2	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 extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent by b) Paracrine c) Synaptic d) Endocrine	2
3	Tissue level of organization • Structural and functional characteristics of following tissues: Epithelial, Connective, Nervous, Muscle	2
4	Integumentary system • Structure and functions of skin	2
5	Skeletal system and Joints • Divisions of skeletal system • Types of bone, salient features and functions of bones	8

	• Organization of skeletal muscle • Physiology of muscle contraction, neuromuscular junction • Structural and functional classification of joints • Types of joints movements and its articulation	
6	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 • Leucopoiesis • Immunity: Basics and types • Disorders of blood, reticuloendothelial system	6
7	Lymphatic system • Components and functions of lymphatic system • Lymphatic organs and tissues • Organization of lymph vessels • Formation and flow of lymph • Functions of lymphatic system	3
8	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 • Methods to measure electrical activity of brain	9
9	Structure and Function of following sensory organs and their disorders: • Eye • Ear • Tongue • Nose	5
10	Cardiovascular system • Functional anatomy of heart • Conducting system of heart, Cardiac cycle, Electrocardiogram (ECG) • Physiology of blood circulation, Functional anatomy of blood vessels • Blood pressure and factors regulating blood pressure, baroreceptors,	7

	chemoreceptors, vasomotor centre, humoral and neuronal control of blood pressure and circulation disorders of heart.	

Recommended Books (Latest Editions):

1. Ross & Wilson, Anatomy & Physiology in Health & Illness by Anne Waugh and Allison Grant, Published by Churchill Livingstone, New York.

2. Gerard J. Tortora & Bryan Derrickson, Principals of Anatomy & Physiology, Published by John Wiley and Sons, Inc.

3. A. C. Guyton & J. E. Hall, Textbook of Medical Physiology, Published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, USA.

4. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander, Published by Churchill Livingstone.

5. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques, Lippincott, Williams and Wilkins, USA.

6. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India.

7. Harsh Mohan, Textbook of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.

8. CC Chatterjee's Human Physiology (vol 1 and 2), CBS Publishers Kolkata.

BP102T

PHARMACEUTICAL ANALYSIS (Theory) 45 Hours

Course Objectives:

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

Course Outcomes:

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
- Perform experiments involving these principles of analysis

Unit	Details	Hours
1	(a) **Pharmaceutical analysis**- Definition and scope i) Different techniques of analysis (Instrumental and Non-Instrumental) ii) Methods of expressing concentration - Molarity, Molality, percent	10

	concentration, ppm, ppb, Normality, Numericals 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, Concepts and numerical of Mean, Median, Standard deviation, Relative standard deviation and Significant figures (c) **Pharmacopoeia** – Introduction to Pharmacopoeial monographs and their significance (relevance of all the tests to be discussed), Sources of impurities in medicinal agents, limit tests	
2	(a) **Titrations** (Theoretical terms) - Titrimetric analysis, Titrant, Titrand, Theoretical end point or equivalence point, End point of titration, Titration error, Conditions for titrimetric analysis, Classification of reactions for titrimetric analysis (b) Law of Mass Action, Equilibrium Constant, pH, pKa, pKb, hydrolysis of salts, Buffer solutions, Buffer Capacity, Numericals for pH calculation (c) **Acid base titration**: Theories of acid base indicators (Ostwald's theory, Resonance theory), Mixed indicators, concept of range of indicators, Choice of indicators; Classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, Neutralization curves; Methods of titration (Direct titration, back titration, blank determination, Factor calculation for assays); Assay of benzoic acid (d) **Non aqueous titration**: Solvents (aprotic, protophilic, protogenic, amphiprotic), characteristics of solvents for non-aqueous titrations (acid-base character, dielectric constant, leveling and differentiating effect), Indicators for non-aqueous titrations, Acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	10
3	(a) **Precipitation titrations**: Common Ion Effect, Solubilty Product, Factors affecting solubility of precipitates, Fractional precipitation; Mohr's method, Volhard's, Modified Volhard's, Fajans method, Standardization of silver nitrate, Estimation of sodium chloride (b) **Complexometric titration**: Terms - Complex, Complexing agents	10

	(Complexones), Chelate, Ligand, Co-ordination number, Chelating agent, Sequestering agent, Metal-ligand complex; Formations of complexes; Classification (Direct method, back titration, replacement titration), Metal ion indicators (pM indicators), masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate, Determination of mixture of lead, zinc and magnesium in a sample (c) **Gravimetry**: Principle and steps involved in gravimetric analysis, Organic and inorganic precipitants, Purity of the precipitate: co-precipitation and post precipitation, Ostwald's ripening, Degree of supersaturation (Von Weimarn ratio), Estimation of barium sulphate, Assay of Aluminium by oxine reagent (d) **Nitrite titrations**: Basic Principles, methods and application of diazotisation titration, Concept of external indicator, Assay of Sulphacetamide sodium	
4	(a) **Redox titrations** i) Concepts of oxidation and reduction - Oxidising and reducing agents, Standard reduction potential, Nernst equation, Redox titration curve and Equivalence point ii) Types of redox titrations (Principle, Titrants, Indicators and Application) – Permanganometry (Assay of hydrogen peroxide), Cerimetry (Assay of Paracetamol and Dried Ferrous sulphate), Iodimetry (Assay of Ascorbic acid API), Iodometry (Assay of potassium permanganate), Bromatometry (Assay of Isoniazid), Dichrometry (Iron), Titration with potassium iodate (Assay of Potassium iodide)	8
5	(a) **Electrochemical methods of analysis** i) **Conductometry**- Introduction, Conductivity cell, Conductometric titrations, applications. ii) **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 (aqueous acid-base titrations -Strong acid vs strong base, strong acid vs weak base, weak acid vs strong base, weak acid vs weak base) and applications. iii) **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, Current-	7

	Voltage curve (Polarogram), supporting electrolyte, Oxygen wave, polarographic maxima, factors affecting limiting current, half wave potential, applications, Pulse polarography-Normal pulse polarography, Differential pulse polarography and square wave polarography	

Reference Books:

1. Practical Pharmaceutical Chemistry by Beckett, A H & Stenlake, J B, 2005, 4thedition, Part I and II, CBS Publishers and Distributors, India.
2. Analytical Chemistry by Gary D. Christian, 6th edition, John Wiley & Sons, Singapore.
3. A Textbook of Pharmaceutical Analysis by Kenneth A. Connors, 2002, 3rd edition, John Wiley and Sons, Canada.
4. Principles of Instrumental Analysis by Douglas A. Skoog, F. James Holler, 1992, 5th edition, Saunders College Publishing, USA.
5. Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West, F. James Holler, 1991, 7th edition, Saunders College Publishing, USA.
6. Vogel's Textbook of Quantitative Chemical Analysis by Mendham J, R.C. Denney, J.D. Barnes, M. Thomas, 2002, 6th edition, Pearson Education Ltd.
7. Pharmaceutical Drug Analysis by Ashutosh Kar, 2005, 2nd edition, New Age International (P) Ltd Publishers, India.
8. Instrumental Methods of Analysis by S. S. Mahajan, 2010, 1st edition, Popular Prakashan Pvt Ltd, India.
9. Instrumental Methods of Chemical Analysis (Analytical Chemistry) by Gurudeep R. Chatwal and Sham. K. Anand, 2008, 5th revised and enlarged edition, Himalaya Publishing House Pvt Ltd.
10. Indian Pharmacopoeia, 2007, 2010 and latest editions.
11. Instrumental Method of Analysis by Willard H.H., L. L. Merritt& John A. Dean, 1986, 6th edition, CBS Publishers & Distributors, New Delhi.
12. Instrumental Method of Chemical Analysis by Ewing Galen W, 1969, 3rd edition, McGraw Hill Book Company, New York.
13. Undergraduate Instrumental Analysis by J.W. Robinson, E.M. Skelly Frame and G.M. Frame II, Pub. Marcel Deckker, 2009
14. Analytical Chemistry, 2nd edition, R. Kellnar, M. Mermet, M. Otto, M. Valcarcel, H. M. Widner.

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

Course Objectives:

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

Course Outcomes:

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

1. Know the history of profession of pharmacy and official compendia
2. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
3. Understand the professional way of handling the prescription and dispensing of medications
4. Describe formulation and evaluation aspect of monophasic liquid formulations
5. Understand the dispensing aspects of dosage forms like powders, monophasic liquids, biphasic systems suppositories and semisolids

Unit	Details	Hours
1	**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
2	**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
3	**Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and	9

	Lotions. **Biphasic liquids:** **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. **Emulsions:** Definition, classification, emulsifying agents, tests for identification of type of Emulsion, Methods of preparation, stability problems and methods to overcome	
4	**Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.	9
5	**Semisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms	7

Reference Books:

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.

2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.

3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.

4. Indian pharmacopoeia.

5. British pharmacopoeia.

6. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.

7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.

8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.

9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.

10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, Inc., New York.

11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, Inc., New York.

12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, Inc., New York.

BP104T

PHARMACEUTICAL INORGANIC CHEMISTRY (Theory) 45 Hours

Course Objectives:

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

Course Outcomes:

Upon completion of the course the student shall be able to

1. know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals.
2. Understand the medicinal and pharmaceutical importance of inorganic compounds

Unit	Details	Hours
1	**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
2	**Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity. **1. 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. **2. Dental products**: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.	10
3	**Gastrointestinal agents**	10

	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	
4	**Miscellaneous compounds** **Expectorants:** Potassium iodide, Ammonium chloride*. **Emetics**: Copper sulphate*, Sodium potassium tartarate **Haematinics:** Ferrous sulphate*, Ferrous gluconate **Poison and Antidote:** Sodium thiosulphate*, Activated charcoal, Sodium nitrite **Astringents**: Zinc Sulphate, Potash Alum	8
5	**Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.	7

Recommended Books (Latest Editions):

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vols. I & II, Stahlone Press of University of London
2. A.I. Vogel, Textbook of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

BP105T

COMMUNICATION SKILLS (Theory) 30 Hours

Course Objectives:

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

Course Outcomes:

Upon completion of the course the student shall be able to

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

Unit	Details	Hours
1	**Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context **1. Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers **2. Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment	7
2	**1. Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style	7
3	**Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations **1. 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 **2. Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message	7
4	**Interview Skills:** Purpose of an interview, Do's and Don'ts of an interview **1. Giving Presentations:** Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery	5
5	**Group Discussion:** Introduction, Communication skills in group discussion,	4

	Do's and Don'ts of group discussion	

Recommended Books: (Latest Edition):

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011

2. Communication skills, Sanjay Kumar, Pushpalata, 1st Edition, Oxford Press, 2011

3. Organizational Behaviour, Stephen. P. Robbins, 1st Edition, Pearson, 2013

4. Brilliant- Communication skills, Gill Hasson, 1st Edition, Pearson Life, 2011

5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5th Edition, Pearson, 2013

6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010

7. Communication skills for professionals, Konar nira, 2nd Edition, New arrivals –PHI, 2011

8. Personality development and soft skills, Barun K Mitra, 1st Edition, Oxford Press, 2011

9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning India Pvt. Ltd. 2011

10. Soft skills and professional communication, Francis Peters SJ, 1st Edition, Mc Graw Hill Education, 2011

11. Effective communication, John Adair, 4th Edition, Pan Mac Millan, 2009.

12. Bringing out the best in people, Aubrey Daniels, 2nd Edition, Mc Graw Hill, 1999.

BP106RBT

Remedial Biology (Theory) **30 Hours**

Course Objectives:

To get the learner acquainted with the facets of biology in the plant and animal kingdom.

Course Outcomes:

The learner should be able to:

1. Understand the classification and features of plant and animal kingdom.
2. Know the anatomy and physiology of plants.
3. Appreciate the anatomy & physiology in animals especially the human body

Unit	Details	Hours
1	Living world: • Definition and characters of living organism • 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	5

2	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	2
3	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	7
4	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 Chemical coordination and regulation Endocrine glands and their secretions • Functions of hormones secreted by endocrine glands Human reproduction	7

	• Parts of female reproductive system • Parts of male reproductive system • Spermatogenesis and Oogenesis • Menstrual cycle	
5	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	5
6	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 organelle, cell division Tissues • Definition, types of tissues, location and functions.	4

Recommended Books (Latest Editions):

1. Textbook of Biology by S. B. Gokhale
2. A Textbook of Biology by Dr. Thulajappa and Dr. Seetaram.
3. A Textbook of Biology by Naidu and Murthy
4. Botany for Degree students By A.C. Dutta
5. Outlines of Zoology by M. Ekambaranatha Ayyer and T. N. Ananthakrishnan
6 A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

BP106RMT

REMEDIAL MATHEMATICS (Theory) 30 Hours

Course Objectives:

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.

Course Outcomes:

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

Unit	Details	Hours
1	**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 **1. Logarithms** Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems. **2. Function***:* Real Valued function, Classification of real valued functions, **3. Limits and continuity**: Introduction, Limit of a function, Definition of limit of a function (ε - δ definition), $\lim_{x\to a}\frac{x^n - a^n}{x-a} = na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta} = 1,$	6
2	**Matrices and Determinant:** Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations	6
3	**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 $\log_e x$, Derivative of a^x , Derivative of	6

	trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application	
4	**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	6
5	**Differential Equations**: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations** **1. 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**	6

Recommended Books (Latest Edition):

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

BP107P

Human Anatomy and Physiology (Practical)

Course Objectives:

To get the learner acquainted with the diagnostic methods employed in detection of the pathology of some disease states

Course Outcomes

The learner should be able to:

1. Perform haematology tests, record the heart rate, pulse and blood pressure and relate the results with clinical conditions.
2. Identify and postulate the position of the bones in human skeleton.
3. Identify and describe the various body tissues and organs based on the structure and organisation of cells.

Unit	Details
1	Study of compound microscope.
2	Microscopic study of permanent slides of tissues: Discussion on the normal as well as pathological changes with the help of charts / images • Columnar, Cuboidal, Squamous, Ciliated Epithelium • Cardiac, Skeletal, Smooth muscle • Ovary, Testis, Liver, Pancreas, Thyroid, Tongue, Stomach, Intestine, Kidney, Lung, Spinal Cord, Cerebrum, Artery, Vein
3	Study of bones: • Axial • Appendicular
4	Introduction to hemocytometry: Determination of the hematology studies and discussion of the pathological deviations from baseline values 1) Red Blood cell (RBC) Count 2) Total Leukocyte Count 3) Differential Leukocyte (WBC) Count 4) Haemoglobin content of blood 5) Bleeding / Clotting Time 6) Blood groups 7) Erythrocyte Sedimentation Rate (ESR) / Hematocrit (Demonstration)
5	Determination of heart rate and pulse rate.
6	Recording of blood pressure.

Recommended Books (Latest Editions):

1. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander, Published by by Churchill Livingstone

2. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques, Published by Lippincott, Williams and Wilkins, USA.

3. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India

4. C. L. Ghai, Textbook of Practical Physiology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

5. Harsh Mohan, Textbook of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.

6. CC Chatterjee's Human Physiology (vol 1 and 2), CBS Publishers Kolkata.

BP108P

PHARMACEUTICAL ANALYSIS (Practical)

Course Objectives:

This course deals with the fundamentals of analytical chemistry and principles of titrimetry, turbidometry, electrochemical analysis and gravimetry

Course Outcomes:

Upon completion of the course student shall be able to -

- Understand the principles of volumetric, turbidometric, electrochemical and gravimetric analysis
- Carryout various these analysis
- Develop skills to analyse the data obtained and make conclusions.

I Preparation and standardization of -

(1) Sodium hydroxide

(2) Sulphuric acid

(3) Sodium thiosulfate

(4) Potassium permanganate

(5) Ceric ammonium sulphate

II Assay of the following compounds along with Standardization of Titrant -

(1) Ammonium chloride by acid base titration

(2) Ferrous sulphate by Cerimetry

(3) Copper sulphate by Iodometry / Sodium metabisulphite

(4) Calcium gluconate by complexometry

(5) Hydrogen peroxide by permanganometry

(6) Sodium benzoate by non-aqueous titration

(7) Sodium Chloride by precipitation titration

(8) Assay of Aspirin (Back titration)

(9) Assay of Sulphacetamide sodium (Nitrite titration)

(10) Assay of Ascorbic acid (Iodimetry)

III 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

(4) Potentiometric titration of weak acid against strong base

IV Gravimetric analysis

(1) Determination of Barium as Barium sulphate

Recommended Books: (Latest Editions):

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London / 4th edition, CBS Publishers and Distributors, India
2. A.I. Vogel, Textbook of Quantitative Inorganic analysis, 5th edition, Longman Publisher, London
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd edition, 1st edition, Birla Publications, New Delhi
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry, 8th edition, Oxford University Press, London
5. John H. Kennedy, Analytical Chemistry principles, 3rd revised edition, Saunders College Publication, 1990
6. Indian Pharmacopoeia 2010, 2014 and latest edition
7. Analytical Chemistry by Gary D. Christian, 6thedition, John Wiley & Sons, Singapore.
8. Vogel's Textbook of Quantitative Chemical analysis by Mendham J, R.C. Denney, J.D. Barnes, M. Thomas, 2002, 6th edition, Pearson Education Ltd

BP109P

PHARMACEUTICS - I (Practical)

Course Objectives:

This course is designed to impart a fundamental knowledge for preparing selected conventional dosage forms.

Course Outcomes:

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

1. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
2. Prepare some simple and conventional dosage forms

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

10	**Gargles and Mouthwashes** a) Iodine gargle b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions):

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.

2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.

3. M. E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.

4. Indian pharmacopoeia.

5. British pharmacopoeia.

6. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.

7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.

8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.

9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.

10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.

11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.

12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

BP110P

PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

I Limit tests for following ions

Limit test for Chlorides and Sulphates

Modified limit test for Chlorides and Sulphates

Limit test for Iron

Limit test for Heavy metals

Limit test for Lead

Limit test for Arsenic

II Identification test

Magnesium hydroxide

Ferrous sulphate

Sodium bicarbonate

Calcium gluconate

Copper sulphate

III Test for purity

Swelling power of Bentonite

Neutralizing capacity of aluminum hydroxide gel

Determination of potassium iodate and iodine in potassium Iodide

IV Preparation of inorganic pharmaceuticals

Boric acid

Potash alum

Ferrous sulphate

Recommended Books (Latest Editions):

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Textbook of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia

BP111P

COMMUNICATION SKILLS (Practical)

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

1. **Basic communication covering the following topics**
   a. Meeting People
   b. Asking Questions
   c. Making Friends

d. What did you do?

e. Do's and Dont's

2. **Pronunciations covering the following topics**

a. Pronunciation (Consonant Sounds)

b. Pronunciation and Nouns

c. Pronunciation (Vowel Sounds)

3. **Advanced Learning**

a. Listening Comprehension / Direct and Indirect Speech

b. Figures of Speech

c. Effective Communication

d. Writing Skills

e. Effective Writing

f. Interview Handling Skills

g. E-Mail etiquette

h. Presentation Skills

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals – PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning India pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

BP112RBP

Remedial Biology (Practical)

Course Objectives:

To give the learner preliminary knowledge of biology.

Course Outcomes

The learner should be able to:

1. Have knowledge of microscope and microscopic study of tissues.
2. Identify plant parts and modification.
3. Explain some body processes.

Unit	Details
1	Introduction to experiments in biology a) Study of Microscope b) Section cutting techniques c) Mounting and staining d) Permanent slide preparation
2	Study of cell and its inclusions
3	Study of stem, root, leaf, seed, fruit, flower and their modifications
4	Detailed study of frog by using computer models
5	Microscopic study and identification of tissues pertinent to stem, root, leaf, seed, fruit and flower
6	Identification of bones
7	Determination of blood group
8	Determination of blood pressure
9	Determination of tidal volume

Reference Books:

1. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
2. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava.
3. Biology practical manual according to National core curriculum. Biology forum of Karnataka. Prof .M.J.H.Shafi

SEMESTER II

BP201T

Human Anatomy and Physiology - II (Theory) 45 Hours

Course Objectives:

To give the learner in-depth information on the organ systems and homeostatic mechanisms.

Course Outcomes:

The learner should be able to:

1. Elucidate the gross morphology, structure and functions of various organs of the human body.
2. Understand the coordinated working pattern of different organs of each system.
3. Correlate the mechanisms in the maintenance of homeostasis of human body by cross functioning of the various systems.

Unit	Details	Hours
1	Nervous system • Organization of nervous system • Neuron, neuroglia, classification and properties of nerve fibre, • Electrophysiology, action potential, nerve impulse • Receptors, synapse and 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)	10
2	Digestive system • Anatomy and physiology of the gastrointestinal tract and associated organs • Functions of stomach • Digestion and absorption of carbohydrates, proteins and fats	5
	Respiratory System • Anatomy and physiology of respiratory system • Exchange of gases • External and internal respiration • Mechanism and regulation of respiration • Lung volumes and lung capacities • Artificial respiration and resuscitation methods	5
	Urinary system	7

	• 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 • Role of kidneys in acid base balance • Role of rennin angiotensin system	
	Endocrine system • Classification of hormones • Mechanism of hormone action • Structure and functions of endocrine tissues and glands • Disorders associated with endocrine system	8
	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	10

Recommended Books (Latest Editions):

1. Ross & Wilson, Anatomy & Physiology in Health & Illness by Anne Waugh and Allison Grant, Published by Churchill Livingstone, New York.

2. Gerard J. Tortora & Bryan Derrickson, Principals of Anatomy & Physiology, Published by John Wiley and Sons, Inc.

3. A. C. Guyton & J. E. Hall, Textbook of Medical Physiology, Published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, USA.

4. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander, Published by Churchill Livingstone

5. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques, Lippincott, Williams and Wilkins, USA.

6. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India.

7. Harsh Mohan, Textbook of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.

8. *CC Chatterjee's* Human Physiology (vol 1 and 2), CBS Publishers Kolkata.

BP202T

PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory) 45 Hours

Course Objectives:

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.

Course Outcomes:

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

Unit	Details	Hours
	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	
1	**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 isomerism in organic compounds	6
2	**Alkanes*, Alkenes* and Conjugated dienes*** SP^3 hybridization in alkanes, halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP^2 hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical	10

	addition reactions of conjugated dienes, allylic rearrangement	
3	**Alkyl halides*** SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. **Alcohols*-** Qualitative tests, Structure and uses of ethyl alcohol, methyl alcohol, chlorobutanol, cetosteryl alcohol, benzyl alcohol, glycerol, propylene glycol	10
4	**Carbonyl compounds* (Aldehydes and ketones)** Nucleophilic addition, electromeric effect, aldol condensation, crossed aldol condensation, Cannizzaro reaction, crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, structure and uses of formaldehyde, paraldehyde, acetone, chloral hydrate, hexamine, benzaldehyde, vanillin, cinnamaldehyde.	9
5	**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	10

Recommended Books (Latest Editions):

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I. L. Finar, Vol. 1
3. Textbook of Organic Chemistry by B. S. Bahl & Arun Bahl.
4. Organic Chemistry by P. L. Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's textbook of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N. K. Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal

BP203T

BIOCHEMISTRY (Theory) **45 Hours**

Course Objectives:

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

Course Outcomes:

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.

Unit	Details	Hours
1	**Biomolecules** Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. **Bioenergetics** Concept of free energy, endergonic and exergonic reaction, relationship between free energy, enthalpy and entropy; Redox potential, energy rich compounds; classification; biological significances of ATP and cyclic AMP	8
2	**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	10

	Phosphorylation Inhibitors ETC and oxidative phosphorylation/uncouplers level	
3	**Lipid metabolism** β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D, disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity. **Amino acid metabolism** General reactions of amino acid metabolism: transamination, deamination & decarboxylation, urea cycle and its disorders Catabolism of phenylalanine and tyrosine and their metabolic disorders (phenyketonuria, albinism, alkeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice	10
4	**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
5	**Enzymes** Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Lineweaver Burke plot, Eadie Hofstee plot), enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes – structure and biochemical functions	7

Recommended Books (Latest Editions):

1. Principles of Biochemistry by Lehninger

2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell
3. Biochemistry by Stryer
4. Biochemistry by D. Satyanarayan and U. Chakrapani
5. Textbook of Biochemistry by Rama Rao
6. Textbook of Biochemistry by Deb
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan
9. Introduction of Practical Biochemistry by David T. Plummer (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna
11. Practical Biochemistry by Harold Varley

BP204T

Pathophysiology (Theory) 45 Hours

Course Objectives:

To impart to the learner the knowledge of pathophysiology and apply it to development of pharmacotherapeutics.

Course Outcomes

The learner should be able to:

1. Describe the etiology and pathogenesis of the selected disease states.
2. Explain the signs and symptoms of the diseases.
3. Deduce the complications of the pathology on health.

Unit	Details	Hours
1	Cell injury and Adaptation: • Basic principles of Introduction, definitions • Homeostasis: components and types of feedback systems • Causes of cellular injury • Mechanisms of cell injury: cell membrane damage, mitochondrial damage, ribosome damage, nuclear damage • Morphology of cell injury: adaptive changes (atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia), cell swelling, intra cellular accumulation, calcification, enzyme leakage • Cell Death and apoptosis • Acidosis & Alkalosis • Electrolyte imbalance	6

2	Inflammation and repair • Basic mechanism involved in the process of inflammation and repair: • 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	4
3	Cancer • Classification • Etiology and pathogenesis of cancer	2
4	Cardiovascular System • Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)	6
5	Respiratory system • Asthma, chronic obstructive airways diseases	2
6	Renal system • Acute and chronic renal failure	2
	Haematological Diseases • Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia	4
	Endocrine system • Diabetes, thyroid diseases, disorders of sex hormones	4
	Nervous system • Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.	6
	Gastrointestinal system • Peptic ulcer, inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease	3
	Disease of bones and joints • Rheumatoid arthritis, osteoporosis and gout	2
	Infectious diseases • Meningitis, typhoid, leprosy, tuberculosis, urinary tract infections	2
	Sexually transmitted diseases	2

	• AIDS, syphilis, gonorrhea	

Recommended Books (Latest Editions):

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.

2. Harsh Mohan; Textbook of Pathology; 6th edition; India; Jaypee Publications; 2010.

3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.

4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;

5. William and Wilkins, Baltimore;1991 [1990 printing].

6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21stedition; London; ELBS/Churchill Livingstone; 2010.

7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.

8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.

9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.

10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals:

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

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

3. Pathology. 1465-3931 (Online)

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

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

BP205T

COMPUTER APPLICATIONS IN PHARMACY (Theory) 30 hours

Course Objectives:

This subject deals with the introduction databases, database management systems, computer application in clinical studies and use of databases.

Course Outcomes:

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

Unit	Details	Hours
1	**Number system**: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary *etc*, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division **Concept of Information Systems and Software:** Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	6
2	**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	6
3	**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	6
4	**Bioinformatics:** Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	6
5	**Computers as data analysis in Preclinical development**: Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)	6

Recommended books (Latest Editions):

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

2. Computer Application in Pharmaceutical Research and Development – Sean Ekins – Wiley-Interscience, A John Willey and Sons, Inc., Publication, USA

3. Bioinformatics (Concept, Skills and Applications) – S. C. Rastogi - CBS Publishers and Distributors, 4596/1-A, 11 Darya Gani, New Delhi – 110 002 (India)

4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N. Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi – 110002

BP206T

ENVIRONMENTAL SCIENCES (Theory) 30 hours

Course Objectives:

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.

Course Outcomes:

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.

Unit	Details	Hours
1	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
2	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
3	Environmental Pollution: air pollution; water pollution; soil pollution	10

Recommended Books (Latest edition):

1. Y. K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India

4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

5. Clark R.S., Marine Pollution, Clanderson Press Oxford

6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p

7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.

8. Down of Earth, Centre for Science and Environment

BP207P

Human Anatomy and Physiology II (Practical)

Course Objectives:

To get the learner adept with anatomy, physiology and pathology of body systems.

Course Outcomes

The learner should be able to:

1. Be proficient with the working of the systems of the body including the process of homeostasis.
2. Identify and describe the various body tissues and the pathological changes in diseased states.

Unit	Details
1	Study of the systems with the help of models, charts and specimens: • Nervous system • Endocrine system • Digestive • Respiratory • Cardiovascular • Urinary • Reproductive
2	To demonstrate the general neurological examination.
3	To study the integumentary and special senses using specimen, models, etc.: • Touch • Olfaction • Taste • Vision and visual acuity
4	To demonstrate the reflex activity.
5	Recording of body temperature.
6	To demonstrate positive and negative feedback mechanism.
7	Determination of tidal volume and vital capacity.
8	Recording of basal mass index.
10	Study of family planning devices and pregnancy diagnosis test.
11	Demonstration of total blood count by cell analyser
12	Permanent slides of vital organs and gonads: • Ovary, Testis, Liver, Pancreas, Thyroid, Tongue, Stomach, Intestine, Kidney, Lung, Spinal Cord, Cerebrum, Artery, Vein

13	Discussion on some common investigational procedures used in diagnostics: 1) Electroencephalogram (EEG) 2) Positron emission tomography (PET) 3) Computed tomography scan (CT Scan 4) Flow cytometry as a diagnostic tool 5) Polymerase chain reaction as a diagnostic tool 6) Electrocardiogram (ECG) in diagnosis of cardiac arrhythmia 7) Liver Function tests 8) Kidney Function tests 9) Blood Glucose 10) Serum Cholesterol / Triglycerides 11) Serum Calcium 12) Thyroid Function tests 13) Diagnostic tests for infectious diseases like - Malaria, Tuberculosis, Dengue, H1N1 swine flu , Typhoid

Recommended Books (Latest Editions):

1. McNaught & Callander, Illustrated Physiology by B. R. Mackenna & R. Callander, Published by by Churchill Livingstone

2. Kaplan, Jack, Opheim, Toivola, Lyon, Clinical Chemistry: Interpretation & Techniques, Published by Lippincott, Williams and Wilkins, USA.

3. Praful B. Godkar, Textbook of Medical Laboratory Technology, Published by Bhalani Publishing House, Mumbai, India

4. C. L. Ghai, Textbook of Practical Physiology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi

5. Harsh Mohan, Textbook of Pathology, Published by Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.

6. Ross & Wilson, Anatomy & Physiology in Health & Illness by Anne Waugh and Allison Grant, Published by Churchill Livingstone, New York.

7. Gerard J. Tortora & Bryan Derrickson, Principals of Anatomy & Physiology, Published by John Wiley and Sons, Inc.

8. A. C. Guyton & J. E. Hall, Textbook of Medical Physiology, Published in India by Prism Books Ltd. on arrangement with W. B. Saunders Company, USA.

BP208P

PHARMACEUTICAL ORGANIC CHEMISTRY - I (Practical)

Unit	Details
1	Systematic qualitative analysis of unknown organic compounds like 1. Preliminary test: color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. 2. Detection of elements like nitrogen, sulphur and halogen by Lassaigne's test 3. Solubility test 4. Functional group test like phenols, amides/ urea, carbohydrates, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, aromatic and halogenated Hydrocarbons, nitro compounds and anilides 5. Melting point/boiling point of organic compounds 6. Identification of the unknown compound from the literature using melting point/ boiling point 7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point 8. Minimum five unknown organic compounds to be analyzed systematically
2	Preparation of suitable solid derivatives from organic compounds
3	Construction of molecular models

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd.
2. Organic Chemistry by I. L. Finar, Vol. 1
3. Textbook of Organic Chemistry by B. S. Bahl & Arun Bahl.
4. Organic Chemistry by P. L. Soni
5. Practical Organic Chemistry by Mann 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
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal

BP209P

BIOCHEMISTRY (Practical)

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

Recommended Books (Latest Editions):

1. Principles of Biochemistry by Lehninger
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell
3. Biochemistry by Stryer
4. Biochemistry by D. Satyanarayan and U. Chakrapani
5. Textbook of Biochemistry by Rama Rao
6. Textbook of Biochemistry by Deb
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan
9. Introduction of Practical Biochemistry by David T. Plummer (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna
11. Practical Biochemistry by Harold Varley

BP210P

COMPUTER APPLICATIONS IN PHARMACY (Practical)

Unit	Details
1	Design a questionnaire using a word processing package to gather information about a disease

2	Create a HTML web page to show personal information
3	Retrieve the information of a drug and its adverse effects using online tools
4	Creating mailing labels Using Label Wizard, generating label in MS WORD
5	Creating mailing labels Using Label Wizard, generating label in MS WORD
6	Create a database in MS Access to store the patient information with the required fields Using MS Access
7	Design a form in MS Access to view, add, delete and modify the patient record in the database
8	Generating report and printing the report from patient database
9	Creating invoice table using – MS Access
10	Drug information storage and retrieval using MS Access
11	Creating and working with queries in MS Access
12	Exporting Tables, Queries, Forms and Reports to web pages
13	Exporting Tables, Queries, Forms and Reports to XML pages

Recommended books (Latest Editions):

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

2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, Inc., Publication, USA

3. Bioinformatics (Concept, Skills and Applications) – S. C. Rastogi - CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002 (India)

4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N. Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi – 110002