

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



Evaluation Scheme & Syllabus
for
B.Pharm. First Year

(Effective from the Session: 2017-18)

Bachelor of Pharmacy (B. Pharm.)

COURSE OF STUDY & SCHEME OF EVALUATION FOR INTERNAL AND END SEMESTER EXAMINATIONS

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

FIRST SEMESTER

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

[#]Applicable ONLY for the students who have studied Mathematics/ Physics/ Chemistry at HSC and appearing for Remedial Biology (RB) course.

[§]Applicable ONLY for the students who have studied Physics/ Chemistry/ Botany/ Zoology at HSC and appearing for Remedial Mathematics (RM) course.

SECOND SEMESTER

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

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

45 Hours

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

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

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

Course Content:

Unit I

10 hours

- **Introduction to human body**

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

- **Cellular level of organization**

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

- **Tissue level of organization**

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

Unit II

10 hours

- **Integumentary system**

Structure and functions of skin

- **Skeletal system**

Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system

Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction.

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

Unit III **10 hours**

- **Body fluids and blood**
- Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.
- **Lymphatic system**
Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system.

Unit IV **08 hours**

Peripheral nervous system:

Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.

Origin and functions of spinal and cranial nerves.

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

Unit V **07 hours**

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

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

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

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

Recommended Books (Latest Editions)

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

6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.
9. Marieb E.N. Human Anatomy and Physiology, Benjamin Cummings (Pearson Education Inc.), San Francisco.
10. Preventive and Social Medicine by Park K., Banarsidas Bhanot Publishers, Jabalpur.
11. Anatomy and Physiology in Health and Illness- by Ross & Wilson Churchill Livingstone, London.
12. Essentials of Anatomy and Physiology- by Seeley R.R., Stephens T.D. and Tate P. McGraw-Hill, New York.
13. Health Education and Community Pharmacy by Parmar N.S., CBS Publishers, Delhi.
14. Health Education and Community Pharmacy by Dandiya, P.C., Zafer, Z.Y.K., and Zafer, A. Vallabh Prakashan, Delhi.
15. Samson Wright's Applied Physiology- by Keele, C.A., Niel, E and Joels N, Oxford University Press, New York.

Reference Books (Latest Editions)

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

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

45 Hours

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

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

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

Course Content:

Unit I

10 Hours

(a) **Pharmaceutical analysis-** Definition and scope

- i) Different techniques of analysis
- ii) Methods of expressing concentration
- iii) Primary and secondary standards.
- iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate

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

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

Unit II

10 Hours

- **Acid base titration:** Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves
- **Non aqueous titration:** Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

Unit III

10 Hours

- **Precipitation titrations:** Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.
- **Complexometric titration:** Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.
- **Gravimetry:** Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.
- Basic Principles, methods and application of diazotization titration.

Unit IV

08 Hours

Redox titrations

(a) Concepts of oxidation and reduction

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

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

Unit-V

07 Hours

Electrochemical methods of analysis

- **Conductometry**- Introduction, Conductivity cell, Conductometric titrations, applications.
- **Potentiometry** - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.
- **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications

BP108P. PHARMACEUTICAL ANALYSIS (Practical)

4 Hours / Week

I Limit Test of the following

- (1) Chloride
- (2) Sulphate
- (3) Iron
- (4) Arsenic

II Preparation and standardization of

- (1) Sodium hydroxide
- (2) Sulphuric acid
- (3) Sodium thiosulfate
- (4) Potassium permanganate
- (5) Ceric ammonium sulphate

III Assay of the following compounds along with Standardization of Titrant

- (1) Ammonium chloride by acid base titration.
- (2) Ferrous sulphate by Cerimetry.
- (3) Copper sulphate by Iodometry.
- (4) Calcium gluconate by complexometry.
- (5) Hydrogen peroxide by Permanganometry.
- (6) Sodium benzoate by non-aqueous titration.
- (7) Sodium Chloride by precipitation titration.

IV Determination of Normality by electro-analytical methods

- (1) Conductometric titration of strong acid against strong base.
- (2) Conductometric titration of strong acid and weak acid against strong base.
- (3) Potentiometric titration of strong acid against strong base.

Recommended Books: (Latest Editions)

1. Vogel's Textbook of Quantitative Chemical Analysis- by Mendham J., Denney R.C., Barnes J.D., Thomas M, Jeffery G.H., Pearson Education Asia.
2. A Text Book of Pharmaceutical Analysis- by Connors K.A., Wiley Inter-science.
3. Practical Pharmaceutical Chemistry- by Beckett A.H., and Stenlake J.B., Vol. I & II. Athlone Press, University of London.
4. British Pharmacopoeia, Her Majesty's Stationary Office, University Press, Cambridge.
5. Quantitative Analysis- by Alexeyev V. CBS Publishers & Distributors, New Delhi.
6. The Pharmacopoeia of India, The Controller of Publications, Delhi.
7. Inorganic Pharmaceutical Chemistry- by P. Gundu Rao.
8. Textbook of Pharmaceutical Chemistry- by Bentley and Driver's.
9. Analytical Chemistry Principles- by John H. Kennedy.

BP103T. PHARMACEUTICS-I (Theory)

45 Hours

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

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

- Know the history of profession of pharmacy.
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations.
- Understand the professional way of handling the prescription.
- Preparation of various conventional dosage forms.

Course Content:

Unit I

10 Hours

- **Historical background and development of profession of pharmacy:** History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.
- **Dosage forms:** Introduction to dosage forms, classification and definitions
- **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription.
- **Posology:** Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

Unit II

10 Hours

- **Pharmaceutical calculations:** Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, allegation, proof spirit and isotonic solutions based on freezing point and molecular weight.
- **Powders:** Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.
- **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

Unit III

08 Hours

- **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasic liquids:**
- **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
- **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

Unit IV

08 Hours

- **Suppositories:** Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
- **Pharmaceutical incompatibilities:** Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

Unit V

07 Hours

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

BP109P. PHARMACEUTICS I (Practical)

3 Hours / week

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

10. Gargles and Mouthwashes

- a) Iodine gargle.
- b) Chlorhexidine mouthwash.

Recommended Books: (Latest Editions)

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

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

45 Hours

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

Objectives: Upon completion of course student shall be able to

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

Course Content:

Unit I

10 Hours

- **Impurities in pharmaceutical substances:** History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate.
- **General methods of preparation,** assay for the compounds superscripted with **asterisk (*)**, properties and medicinal uses of inorganic compounds belonging to the following classes.

Unit II

10 Hours

- **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.
- **Major extra and intracellular electrolytes:** Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.
- **Dental products:** Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

Unit III

10 Hours

- **Gastrointestinal agents**
Acidifiers: Ammonium chloride* and Dil. HCl.
Antacid: Ideal properties of antacids, combinations of antacids, Sodium

Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture.

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite.

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

Unit IV

08 Hours

- **Miscellaneous compounds**

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartarate.

Haematinics: Ferrous sulphate*, Ferrous gluconate.

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

Astringents: Zinc Sulphate, Potash Alum.

Unit V

07 Hours

- **Radiopharmaceuticals:** Radio activity, measurement of radioactivity, properties of α , β , γ radiations, half life, radio isotopes and study of radio isotopes- Sodium iodide I^{131} , storage conditions, precautions & pharmaceutical application of radioactive substances.

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

4 Hours / Week

I Limit tests for following ions

Limit test for Chlorides and Sulphates

Modified limit test for Chlorides and Sulphates

Limit test for Iron

Limit test for Heavy metals

Limit test for Lead

Limit test for Arsenic

II Identification test

Magnesium hydroxide

Ferrous sulphate

Sodium bicarbonate

Calcium gluconate

Copper sulphate

III Test for purity

Swelling power of Bentonite

Neutralizing capacity of aluminum hydroxide gel

Determination of potassium iodate and iodine in potassium Iodide

IV Preparation of inorganic pharmaceuticals

Boric acid

Potash alum

Ferrous sulphate

Recommended Books (Latest Editions)

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

BP105T. COMMUNICATION SKILLS (Theory)

30 Hours

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

Objectives:

Upon completion of the course the student shall be able to

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

Course content:

Unit I

07 Hours

- **Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context.
- **Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers.
- **Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

Unit II

07 Hours

- **Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.
- **Communication Styles:** Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

Unit III**07 Hours**

- **Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations.
- **Effective Written Communication:** Introduction, When and When Not to Use Written Communication- Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication.
- **Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message.

Unit IV**05 Hours**

- **Interview Skills:** Purpose of an interview, Do's and Dont's of an interview.
- **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery.

Unit V**04 Hours**

- **Group Discussion:** Introduction, Communication skills in group discussion, Do's and Dont's of group discussion.

BP111P. COMMUNIUCATION SKILLS (Practical)

2 Hours / Week

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

Basic communication covering the following topics

Meeting People.

Asking Questions.

Making Friends.

What did you do?

Do's and Dont's.

Pronunciations covering the following topics

Pronunciation (Consonant Sounds).

Pronunciation and Nouns.

Pronunciation (Vowel Sounds).

Advanced Learning

Listening Comprehension / Direct and Indirect Speech.

Figures of Speech.

Effective Communication.

Writing Skills.

Effective Writing. Interview

Handling Skills.

E-Mail etiquette.

Presentation Skills.

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 Behavior, 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.

BP 106RBT. 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 content:

Unit I

07 Hours

Living world:

- Definition and characters of living organisms
- Diversity in the living world
- Binomial nomenclature
- Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus,

Morphology of flowering plants

- Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
- General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledons.

Unit II

07 Hours

Body fluids and circulation

- Composition of blood, blood groups, coagulation of blood
- Composition and functions of lymph
- Human circulatory system
- Structure of human heart and blood vessels
- Cardiac cycle, cardiac output and ECG

Digestion and absorption

- Human alimentary canal and digestive glands
- Role of digestive enzymes
- Digestion, absorption and assimilation of digested food

Breathing and respiration

- Human respiratory system
- Mechanism of breathing and its regulation
- Exchange of gases, transport of gases and regulation of respiration
- Respiratory volumes

Unit III

07 Hours

Excretory products and their elimination

- Modes of excretion
- Human excretory system- structure and function
- Urine formation
- 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

- Parts of female reproductive system
- Parts of male reproductive system
- Spermatogenesis and Oogenesis
- Menstrual cycle

Unit IV

05 Hours

Plants and mineral nutrition:

- Essential mineral, macro and micronutrients
- Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

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

Unit V

04 Hours

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

Plant growth and development

- Phases 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

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

Reference Books

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

BP112RBP. REMEDIAL BIOLOGY (Practical)

30 Hours

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

Reference Books

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

BP 106RMT. REMEDIAL MATHEMATICS (Theory)

30 Hours

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

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

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

Course Content:

Unit I

06 Hours

- **Partial fraction:** Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics.
- **Logarithms:** Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.
- **Function:** Real Valued function, Classification of real valued functions,
- **Limits and continuity:** Introduction , Limit of a function, Definition of limit of a function ($\epsilon - \delta$

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

Unit II

06 Hours

- **Matrices and Determinant:**

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

Unit III

06 Hours

- **Calculus**

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

Unit IV

06 Hours

- **Analytical Geometry**

Introduction: Signs of the Coordinates, Distance formula,

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

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

Unit V

06 Hours

- **Differential Equations:** Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations.
- **Laplace Transform** : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving chemical kinetics and Pharmacokinetics equations.

Recommended Books (Latest Edition)

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

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

45 Hours

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

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

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

Course Content:

Unit I

10 hours

- **Nervous system**

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity).

Unit II

06 hours

- **Digestive system**

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

- **Energetics**

Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III

- **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.

Unit IV

10 hours

- **Endocrine system**

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

Unit V

09 hours

- **Reproductive system**

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

- **Introduction to genetics**

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

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

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

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

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee Brothers Medical Publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co., Riverview, MI, USA.
4. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee Brothers Medical Publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee Brothers Medical Publishers, New Delhi.
8. Practical Workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee Brother's Medical Publishers, New Delhi.
9. Dipiro J.L., Pharmacotherapy- A Pathophysiological Approach, Elsevier, Amsterdam.
10. Chaurasia B.D, Human Anatomy, Regional & Applied Part I, II & III, CBS Publishers & Distributors, New Delhi.

11. Ross and Wilson, Anatomy and Physiology in Health and Illness, Churchill Livingstone, London.
12. Seeley R.R., Stephens T.D. and Tate, P. Essentials of Anatomy and Physiology, McGraw-Hill, New York.

Reference Books:

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

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

45 Hours

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

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

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

Course Content:

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained.

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences.

Unit-I

07 Hours

- **Classification, nomenclature and isomerism**

Classification of Organic Compounds

Common and IUPAC systems of nomenclature of organic compounds

(up to 10 Carbons open chain and carbocyclic compounds)

Structural isomerisms in organic compounds

Unit II

10 Hours

- **Alkanes*, Alkenes* and Conjugated dienes***

SP³ hybridization in alkanes, Halogenation of alkanes, uses of paraffins.

Stabilities of alkenes, SP² hybridization in alkenes.

E₁ and E₂ reactions – Kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E₁ versus E₂ reactions, Factors affecting E₁ and E₂ reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement.

Unit III

10 Hours

- **Alkyl halides***

SN₁ and SN₂ reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN₁ versus SN₂ reactions, Factors affecting SN₁ and SN₂ reactions.

Structure and uses of ethylchloride, chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

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

Unit IV

10 Hours

- **Carbonyl compounds* (Aldehydes and ketones)**

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

Unit V

08 Hours

- **Carboxylic acids***

Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester

Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

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

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

4 Hours / week

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

Recommended Books (Latest Editions)

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

BP203 T. BIOCHEMISTRY (Theory)

45 Hours

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

Objectives: Upon completion of course student shall be able to

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

Course Content:

Unit I

08 Hours

- **Biomolecules**

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

- **Bioenergetics**

Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential.

Energy rich compounds; classification; biological significances of ATP and cyclic AMP

Unit II

10 Hours

- **Carbohydrate metabolism**

Glycolysis- Pathway, energetics and significance.

Citric acid cycle- Pathway, energetics and significance.

HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency.

Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance.

Hormonal regulation of blood glucose level and Diabetes mellitus.

- **Biological oxidation**

Electron transport chain (ETC) and its mechanism.

Oxidative phosphorylation & its mechanism and substrate level phosphorylation.

Inhibitors ETC and oxidative phosphorylation/Uncouplers.

Unit III

10 Hours

- **Lipid metabolism**

β -Oxidation of saturated fatty acid (Palmitic acid). Formation and utilization of ketone bodies; ketoacidosis. De novo synthesis of fatty acids (Palmitic acid).

Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D.

Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

- **Amino acid metabolism**

General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders.

Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alpeptonuria, tyrosinemia).

Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline.

Catabolism of heme; hyperbilirubinemia and jaundice.

Unit IV

10 Hours

- **Nucleic acid metabolism and genetic information transfer**

Biosynthesis of purine and pyrimidine nucleotides.

Catabolism of purine nucleotides and Hyperuricemia and Gout disease.

Organization of mammalian genome.

Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis.

Genetic code, Translation or Protein synthesis and inhibitors.

Unit V

07 Hours

- **Enzymes**

Introduction, properties, nomenclature and IUB classification of enzymes.

Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples.

Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation.

Therapeutic and diagnostic applications of enzymes and isoenzymes.

Coenzymes –Structure and biochemical functions.

BP 209 P. BIOCHEMISTRY (Practical)

4 Hours / Week

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

Recommended Books (Latest Editions)

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

BP 204T. PATHOPHYSIOLOGY (THEORY)

45Hours

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

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

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

Course content:

Unit I

10 Hours

Basic principles of Cell injury and Adaptation:

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

Basic mechanism involved in the process of inflammation and repair:

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

Unit II

10Hours

- **Cardiovascular System:**

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

- **Respiratory system:** Asthma, Chronic obstructive airways diseases.
- **Renal system:** Acute and chronic renal failure.

Unit III**10Hours**

- **Haematological Diseases:**

Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, 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.

- **Gastrointestinal system:** Peptic Ulcer.

Unit IV**8 Hours**

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

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

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

Unit V**7 Hours**

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

- **Sexually transmitted diseases:** AIDS, Syphilis, Gonorrhoea.

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins & Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states; William and Wilkins, Baltimore; 1991 [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston; Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 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,
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

30 Hrs (2 Hrs/Week)

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

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

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

Course content:

Unit I

06 hours

Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division

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

Unit II

06 hours

Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products.

Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database.

Unit III

06 hours

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring

Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System.

Unit IV

06 hours

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

Unit V

06 hours

Computers as data analysis in Preclinical development:

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

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

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

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John 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.

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

30 hours

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

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

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

Course content:

Unit I

10hours

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.

Unit II

10hours

Ecosystems

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

Unit III

10hours

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Singh, Y.K. Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clarendon 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.