List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pharmacy*

Programme Name : *B. Pharm. (1st Semester)*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	BP101T	Human Anatomy and Physiology I–Theory
02.	BP102T	Pharmaceutical Analysis I – Theory
03.	BP103T	Pharmaceutics I – Theory
04.	BP104T	Pharmaceutical Inorganic Chemistry –Theory
05.	BP105T	Communication skills – Theory *
06.	BP106RBT/BP106RMT	Remedial Biology/Remedial Mathematics – Theory*
07.	BP107P	Human Anatomy and Physiology – Practical
08.	BP108P	Pharmaceutical Analysis I – Practical
09.	BP109P	Pharmaceutics I – Practical
10.	BP110P	Pharmaceutical Inorganic Chemistry –Practical
11.	BP111P	Communication skills – Practical*
12.	BP112RBP	Remedial Biology – Practical*

HEAD
S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pharmacy*

Programme Name : *B. Pharm. (2nd Semester)*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	BP201T	Human Anatomy and Physiology II – Theory
02.	BP202T	Pharmaceutical Organic Chemistry I – Theory
03.	BP203T	Biochemistry – Theory
04.	BP204T	Pathophysiology – Theory
05.	BP205T	Computer Applications in Pharmacy – Theory *
06.	BP206T	Environmental sciences – Theory *
07.	BP207P	Human Anatomy and Physiology II –Practical
08.	BP208P	Pharmaceutical Organic Chemistry I– Practical
09.	BP209P	Biochemistry – Practical
10.	BP210P	Computer Applications in Pharmacy – Practical*

HEAD
S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pharmacy*

Programme Name : *B. Pharm. (3rd Semester)*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	BP301T	Pharmaceutical Organic Chemistry II – Theory
02.	BP302T	Physical Pharmaceutics I – Theory
03.	BP303T	Pharmaceutical Microbiology – Theory
04.	BP304T	Pharmaceutical Engineering – Theory
05.	BP305P	Pharmaceutical Organic Chemistry II – Practical
06.	BP306P	Physical Pharmaceutics I – Practical
07.	BP307P	Pharmaceutical Microbiology – Practical
08.	BP 308P	Pharmaceutical Engineering –Practical

HEAD
S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pharmacy*

Programme Name : *B. Pharm. (4th Semester)*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	BP401T	Pharmaceutical Organic Chemistry III– Theory
02.	BP402T	Medicinal Chemistry I – Theory
03.	BP403T	Physical Pharmaceutics II – Theory
04.	BP404T	Pharmacology I – Theory
05.	BP405T	Pharmacognosy and Phytochemistry I– Theory
06.	BP406P	Medicinal Chemistry I – Practical
07.	BP407P	Physical Pharmaceutics II – Practical
08.	BP408P	Pharmacology I – Practical
09.	BP409P	Pharmacognosy and Phytochemistry I – Practical

HEAD
S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pharmacy*

Programme Name : *B. Pharm. (5th Semester)*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	501	Pharmaceutical Chemistry-V (Medicinal Chemistry-I)
02.	502	Pharmaceutical Chemistry-V (Practical)
03.	503	Pharmaceutics-V (Pharmaceutical Technology-I)
04.	504	Pharmaceutics-V (Pharmaceutical Technology-I) (Practical)
05.	505	Pharmacognosy-III
06.	506	Pharmacognosy-III (Practical)
07.	507	Pharmacology-II
08.	508	Pharmacology-II (Practical)
09.	509	Pharmaceutical Microbiology
10.	510	Pharmaceutical Microbiology (Practical)

HEAD
S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pharmacy*

Programme Name : *B. Pharm. (6th Semester)*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	601	Pharmaceutical Chemistry-VI (Medicinal Chemistry-II)
02.	602	Pharmaceutical Chemistry-VI (Practical)
03.	603	Pharmaceutics-VI (Pharmaceutical Technology-II)
04.	604	Pharmaceutics-VI (Pharmaceutical Technology-II) (Practical)
05.	605	Pharmacognosy-IV
06.	606	Pharmacognosy-IV (Practical)
07.	607	Pharmacology-III
08.	608	Pharmacology-III (Practical)
09.	609	Forensic pharmacy & Ethics
10.	611	Pharmaceutical Chemistry-VI (Medicinal Chemistry-II)
11.	601	Pharmaceutical Chemistry-VI (Practical)

HEAD
S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pharmacy*

Programme Name : *B. Pharm. (7th Semester)*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	1907-701	Pharmaceutical Chemistry-VII (Medicinal Chemistry-III)
02.	1907-702	Pharmaceutics-VIII (Biopharmaceutics & Pharmacokinetics)
03.	1907-703	Pharmaceutical Biotechnology
04.	1907-704	Pharmacology-IV
05.	1907-705	Pharmaceutical Industrial Management
06.	1907-706A	Bioavailability & Therapeutic Drug Monitoring
07.	1907-706B	Drug Design

HEAD
S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pharmacy*

Programme Name : *B. Pharm. (8th Semester)*

Academic Year : 2019-20

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	1908-801	Pharmaceutical Chemistry-VIII (Medicinal Chemistry-IV)
02.	1908-802	Pharmaceutical Analysis-III
03.	1908-803	Pharmaceutics-IX (Dosages Form Design)
04.	1908-804	Pharmacognosy-V (including Herbal Technology)
05.	1908-805	Pharmacology-V (Clinical Pharmacy)
06.	1908-806	Open Elective: Cosmetology/ Quality Assurance
07.	1908-807	Project (Library Assignment)

HEAD
S.L.T. Institute of Pharm. Sciences
Guru Ghasidas Vishwavidyalaya,
Bilaspur (C.G.)

Scheme and Syllabus

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 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; * Non University Examination (NUE)

Scheme and Syllabus

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**

*Non University Examination (NUE)

Scheme and Syllabus

Course of study for Semester III

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	Physical Pharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
	Total	**28**	**4**	**24**

Scheme and Syllabus

Course of study for Semester IV

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4	-	2
BP408P	Pharmacology I – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
	Total	**31**	**5**	**28**

Course Code	Course	Hrs/week	Credit Points	Marks
5th Semester				
501	Pharmaceutical Chemistry-V (Medicinal Chemistry-I)	3	3	100
502	Pharmaceutical Chemistry-V (Practical)	4	2	100
503	Pharmaceutics-V (Pharmaceutical Technology-I)	3	3	100
504	Pharmaceutics-V (Pharmaceutical Technology-I) (Practical)	4	2	100
505	Pharmacognosy-III	3	3	100
506	Pharmacognosy-III (Practical)	4	2	100
507	Pharmacology-II	3	3	100
508	Pharmacology-II (Practical)	4	2	100
509	Pharmaceutical Microbiology	3	3	100
510	Pharmaceutical Microbiology (Practical)	4	2	100
	Total	35	25	1000
6th Semester				
601	Pharmaceutical Chemistry-VI (Medicinal Chemistry-II)	3	3	100
602	Pharmaceutical Chemistry-VI (Practical)	4	2	100
603	Pharmaceutics-VI (Pharmaceutical Technology-II)	3	3	100
604	Pharmaceutics-VI (Pharmaceutical Technology-II) (Practical)	4	2	100
605	Pharmacognosy-IV	3	3	100
606	Pharmacognosy-IV (Practical)	4	2	100
607	Pharmacology-III	3	3	100
608	Pharmacology-III (Practical)	4	2	100
609	Forensic pharmacy & Ethics	3	3	100
	Total	31	23	900

Course Code	Course	Theory (Hrs/week)	Practical (Hrs/week)	Credit Points (T+P)	Marks
		7th Semester			
1907-701	Pharmaceutical Chemistry-VII (Medicinal Chemistry-III)	3	4	3+2	200
1907-702	Pharmaceutics-VIII (Biopharmaceutics & Pharmacokinetics)	3	4	3+2	200
1907-703	Pharmaceutical Biotechnology	3	4	3+2	200
1907-704	Pharmacology-IV	3	4	3+2	200
1907-705	Pharmaceutical Industrial Management	3	-	3	100
1907-706A	**Open Elective**: (Bioavailability and Therapeutic Drug Monitoring OR Drug Design)	3	-	3	100
	Total	18	16	26	1000
		8th Semester			
1908-801	Pharmaceutical Chemistry-VIII (Medicinal Chemistry-IV)	3	4	3+2	200
1908-802	Pharmaceutical Analysis-III	3	4	3+2	200
1908-803	Pharmaceutics-IX (Dosages Form Design)	3	4	3+2	200
1908-804	Pharmacognosy-V (including Herbal Technology)	3	4	3+2	200
1908-805	Pharmacology-V (Clinical Pharmacy)	3	-	3	100
1908-806	**Open Elective**: Cosmetology/ Quality Assurance	3	-	3	100
1908-807	Project (Library Assignment)	-	4	2	100
	Total	18	20	28	1100

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

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 Sense**
  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 andJohn.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.

Reference Books (Latest Editions)

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

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **10 Hours**

(a) Pharmaceutical analysis- Definition and scope

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

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

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

UNIT-II **10 Hours**

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

UNIT-III **10 Hours**

- **Precipitation titrations:** Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.
- **Complexometric titration:** Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.
- **Gravimetry:** Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.
- Basic Principles,methods and application of diazotisation 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. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book 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.

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, 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

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) Aluminimum 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. 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

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 40 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 I131, 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. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4 th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3 rd 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

BP105T. COMMUNICATION SKILLS (Theory)

30 Hours

Scope:

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

Objectives:

Upon completion of the course the student shall be able to

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

Course content:

UNIT – I **07 Hours**

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

UNIT – II **07 Hours**

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

UNIT – III **07 Hours**

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

UNIT – IV **05 Hours**

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

UNIT – V **04 Hours**

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

BP111P.COMMUNICATION SKILLS (Practical)

2 Hours / week

The following learning modules are to be conducted using wordsworth® 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, 2 nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1 stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1 stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1 stEdition, 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, 2 ndEdition, New arrivals – PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1 stEdition, 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, 1 stEdition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4 thEdition, Pan Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2 ndEdition, 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

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, Potista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering plants

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

.

UNIT – II **07 Hours**

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

a. Text book of Biology by S. B. Gokhale
b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Reference Books

a. A Text book of Biology by B.V. Sreenivasa Naidu
b. A Text book of Biology by Naidu and Murthy
c. Botany for Degree students By A.C.Dutta.
d.Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
e. 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.Shriwastava.
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 **07 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 ($\in$ - δ definition),

$$\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1} \quad \lim_{\theta\to 0}\frac{sin\theta}{\theta}=1$$

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,Applicationof 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.tx,where n is any rational number, Derivative of e x ,, Derivative of loge 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 Shan thinarayan
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 **10 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 54 and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.
- **Energetics**
  Formation and role of ATP, Creatinine Phosphate and BMR.

UNIT – III **10 Hours**

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

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

UNIT – IV **10 Hours**

- **Endocrine system**

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

UNIT – V **09 Hours**

- **Reproductive system**

  Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition
- Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

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

1. To study the integumentary and special senses using specimen, models, etc.,
2. To study the nervous system using specimen, models, etc.,
3. To study the endocrine system using specimen, models, etc
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of taste.
7. To demonstrate the visual acuity
8. To demonstrate the reflex activity
9. Recording of body temperature
10. To demonstrate positive and negative feedback mechanism.
11. Determination of tidal volume and vital capacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary 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 analyser
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 andJohn.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.

Reference Books:

1. Physiological basis of Medical Practice-Best and Tailor. 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 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 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 – IV **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

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 5 unknown organic compounds to be analysed 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, Volume-I
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.

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 shell able to

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

Course 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 phosphorylation
  Inhibitors ETC and oxidative phosphorylation/Uncouplers level

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 (Phenyketonuria, Albinism, alkeptonuria, 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 **10 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

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.

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 **10 Hours**

- **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 **10 Hours**

- **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 **08 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
- **Diseases of bones and joints:** Rheumatoid Arthritis, Osteoporosis,Gout
- **Principles of Cancer:** Classification, etiology and pathogenesis of Cancer

UNIT – V **07 Hours**

- **Infectious diseases:** Meningitis,Typhoid, Leprosy, Tuberculosis Urinary tract infections
- Sexually transmitted diseases: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; Text book of Pathology; 6 th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K.; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12 th 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; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12 th edition; WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9 th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6 th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3 rd 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.

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 dada 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 **10 Hours**

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 **10 Hours**

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. 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 Pu blishing 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

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

45 Hours

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

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

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. prepare organic compounds

Course Content:

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

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

UNIT – I **10 Hours**

- **Benzene and its derivatives**

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

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

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

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

UNIT – II **10 Hours**

- **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols
- **Aromatic Amines*** - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts
- **Aromatic Acids*** –Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT – III **10 Hours**

- **Fats and Oils**
  - **a.** Fatty acids – reactions.
  - **b.** Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.
  - **c.** Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT – IV **10 Hours**

- **Polynuclear hydrocarbons:**

a. Synthesis, reactions

b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

UNIT – V **10 Hours**

- **Cyclo alkanes***

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

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

4 Hrs/week

I Experiments involving laboratory techniques

- Recrystallization
- Steam distillation

II Determination of following oil values (including standardization of reagents)

- Acid value
- Saponification value
- Iodine value

III **Preparation of compounds**

- Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
- 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
- Acetanilide by halogenation (Bromination) reaction.
- 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
- Benzoic acid from Benzyl chloride by oxidation reaction.
- Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
- 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
- Benzil from Benzoin by oxidation reaction.
- Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
- Cinnammic acid from Benzaldehyde by Perkin reaction
- P-Iodo benzoic acid from P-amino benzoic acid

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry 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.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45Hours

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

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

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

Course Content:

UNIT – I **10 Hours**

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

UNIT – II **10 Hours States**

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

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

UNIT – III **08 Hours**

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

UNIT – IV **08 Hours**

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

UNIT – V **07 Hours**

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

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

4 Hrs/week

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co-efficient of Iodine in CCl_4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and Manavalan R.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Pharmacy, by Gaurav Jain & Roop K. Khar

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45Hours

Scope:

- Study of all categories of microorganisims especially for the production of alchol antibiotics, vaccines, vitamins enzymes etc..

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

1. Understand methods of identification, cultivation and preservation of various microorganisms

2. To understand the importance and implementation of sterlization in pharmaceutical processing and industry

3. Learn sterility testing of pharmaceutical products.

4. Carried out microbiological standardization of Pharmaceuticals.

5. Understand the cell culture technology and its applications in pharmaceutical industries.

Course content:

UNIT – I **10 Hours**

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

UNIT – II **10 Hours**

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

UNIT – III **10 Hours**

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

UNIT – IV **08 Hours**

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

UNIT – V **08 Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.

Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.

Application of cell cultures in pharmaceutical industry and research.

307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hrs/week

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

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4 th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan: Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

45 Hours

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

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

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

Course content:

UNIT – I **10 Hours**

- **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.
- **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.
- **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

UNIT – II **10 Hours**

- **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.
- **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.
- **Distillation:** Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular
  distillation

UNIT – III **08 Hours**

- **Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles,

construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

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

UNIT – IV **08 Hours**

- **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.
- **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT – IV **08 Hours**

(a) Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for pharmaceutical plant construction, Theories of corrosion, types of corrosion and their prevention. Ferrous and nonferrous metals, inorganic and organic nonmetals, basic of material handling systems. 83

Recommended Books: (Latest Editions)

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

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/week

I. Determination of radiation constant of brass, iron, unpainted and painted glass.
II. Steam distillation – To calculate the efficiency of steam distillation.
III. To determine the overall heat transfer coefficient by heat exchanger.
IV. Construction of drying curves (for calcium carbonate and starch).
V. Determination of moisture content and loss on drying.
VI. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
XII. To study the effect of time on the Rate of Crystallization.
XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

45 Hours

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

Objectives: At the end of the course, the student shall be able to

1. understand the methods of preparation and properties of organic compounds
2. explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3. know the medicinal uses and other applications of organic compounds

Course Content:

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

UNIT-I **10 Hours**

Stereo isomerism

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

UNIT-II **10 Hours**

Geometrical isomerism

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers.

Conformational isomerism in Ethane, n-Butane and Cyclohexane.

Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.

Stereospecific and stereoselective reactions

UNIT-III **10 Hours**

Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV **8 Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine

Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT-V **07 Hours**

Reactions of synthetic importance

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction.

Beckmanns rearrangement and Schmidt rearrangement.

Claisen-Schmidt condensation

Recommended Books (Latest Editions)

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

BP402T. MEDICINAL CHEMISTRY – I (Theory)

45 Hours

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

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

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

Course Content:

Study of the development of the following classes of drugs, Classification, mechanismof action, uses of drugs mentioned in the course, Structure activity relationship of selectiveclass of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT- I **10 Hours**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry

Physicochemical properties in relation to biological action

Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10 Hours**

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

- Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.
- Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.
- Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

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

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

UNIT-III **10 Hours**

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

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

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

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

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

UNIT- IV **08 Hours**

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

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

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

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

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

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

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

Barbiturates: Phenobarbitone, Methabarbital.

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin

Oxazolidine diones: Trimethadione, Paramethadione
Succinimides: Phensuximide, Methsuximide, Ethosuximide*
Urea and monoacylureas: Phenacemide, Carbamazepine*
Benzodiazepines: Clonazepam Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V **07 Hours**

Drugs acting on Central Nervous System
General anesthetics:
Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.
Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride.*
Narcotic and non-narcotic analgesics
Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.
Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.
Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

BP406P. MEDICINAL CHEMISTRY – I (Practical)

4 Hours/Week

I Preparation of drugs/ intermediates

1. 1,3-pyrazole
2. 1,3-oxazole
3. Benzimidazole
4. Benztriazole
5. 2,3- diphenyl quinoxaline
6. Benzocaine
7. Phenytoin
8. Phenothiazine
9. Barbiturate

II Assay of drugs

1. Chlorpromazine
2. Phenobarbitone
3. Atropine
4. Ibuprofen
5. Aspirin
6. Furosemide

III Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

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

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **07 Hours**

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

UNIT-II **10 Hours**

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

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

UNIT-III **10 Hours**

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

UNIT-IV **10 Hours**

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

UNIT-V **10 Hours**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent,

ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention.

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)

3 Hrs/week

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

Recommended Books: (Latest Editions)

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

BP 404 T. PHARMACOLOGY-I (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **08 hours**

1. General Pharmacology

a. Introduction to Pharmacology - Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT-II **12 Hours**

General Pharmacology

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

UNIT-III **10 Hours**

2. Pharmacology of drugs acting on peripheral nervous system

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

UNIT-IV **08 Hours**

3. Pharmacology of drugs acting on central nervous system

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

UNIT-V **07 Hours**

3. Pharmacology of drugs acting on central nervous system

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

BP 408 P.PHARMACOLOGY-I (Practical)

4 Hrs/Week

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

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

Recommended Books: (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology 100
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan,

BP 405 T. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

45 Hours

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

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

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

Course Content:

UNIT-I **10 Hours**

Introduction to Pharmacognosy:

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

Classification of drugs:

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

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II **10 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin:

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

Conservation of medicinal plants

UNIT-III **07 Hours**

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.

Applications of plant tissue culture in pharmacognosy.

Edible vaccines

UNIT IV **10 Hours**

Pharmacognosy in various systems of medicine:

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

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT V **08 Hours**

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

Plant Products:

Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

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

Carbohydrates: Acacia, Agar, Tragacanth, Honey

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

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

Marine Drugs: Novel medicinal agents from marine sources

BP408 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4 Hours/Week

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

Recommended Books: (Latest Editions)

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

B. PHARM. (5th SEMESTER)

501 – Pharmaceutical Chemistry – V (Medicinal Chemistry-I)

1. Basic principle of Medicinal Chemistry, History and development of medicinal chemistry.
2. Physicochemical properties in relation to biological action: Ionization, drug distribution and pka values, hydrogeon bonding, protein binding, chelation, isosterism, optical and gasometrical isomerism, Types of receptors, drug receptor interaction including signal transduction mechanisms.
3. The following topics shall cover structure, nomenclature classification, synthesis, SAR and metabolism of drugs official in IP & B.P.

(i) Antihypertensive drugs
(ii) Antiarrhythmic drugs
(iii) Antianginal drugs
(iv) Diuretic drugs
(v) Hypoglycaemic drugs: Insulin and oral hypoglycaemic drugs.
(vi) Antihyperlipidemic drugs.
(vii) Vasodilators
(viii) Cardiotonic agents.

503 – Pharmaceutics – V (Pharmaceutical Technology - I)

Capsules: Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption, quality control, storage of capsule dosage forms.

2. **Tablets:** Formulation of different types of tablets, granulation technology on large-scale by various techniques, different types of tablets, equipments employed and evaluation of tablets.
Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating process, evaluation of coated tablets.

3. **Semisolid Dosage Forms:** Definitions, mechanisms of drug penetration, factors influencing penetration. **(a)** Ointment: Classification, bases, preparation method, factor, evaluation and packaging.
(b) Cream: Classification, preparation, evaluation and packaging.

4. **Suppositories:** Ideal requirements, bases, manufacturing procedure, evaluation and packaging.

5. **Pharmaceutical Aerosols:** Definition, propellants, general formulation, manufacturing, packaging, evaluation methods and pharmaceutical applications.

6. **Packaging of pharmaceuticals.** Types of containers, glass and plastic materials used, closures, packaging of tablets, capsules & parenteral dosage forms, test for containers and closures.

505 – Pharmacognosy – III

Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substituents, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides:

(i) Saponins: Liquorice, ginseng, dioscorea, sarsaparilla and senega
(ii) Cardioactive sterols: Digitalis, squill, strophanthus and thevetia.
(iii) Anthraquinone cathartics: Aloe, senna, rhubarb and cascara
(iv) Others: Psoralea, Ammi majus, Ammi visnaga, gentian, saffron, chirata, quassia.

2. Studies of traditional drugs, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Amla, Kantkari, Satavari, Tylophora, Bhilawa, Kalijiri, Bach, Rasna, Punarnava, chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Adusa, Arjuna, Ashoka, Methi, bahsun, Palash, Guggal, Gyumnema, Shilajit, Nagarmotha, Neem, Tulsi

3. Natural Allergen: Introduction, classification, cause, history, skin test, treatment, inhalant, ingestant, injectant, contactant, infectant, infestant, allergen, plants causing allergy.

4. Study of Natural Pesticide: Introduction, methods and control of pest with special reference to pyrethrum and neem.

5. Pharmaceutical Enzyme- Diastase, Pepsin, Trypsin, Papain and Pancreatin.

507 – Pharmacology – II

Pharmacology of Central Nervous System: General considerations, Alcohol and Disulfiram, General anesthetics. Sedatives, hypnotics, anti-anxiety agents and centrally acting muscle relaxants. Psychopharmacological agents anti psychotics, antidepressants, anti maniacs and hallucinogens. Anti-Epileptic drugs. Anti-Parkinsonian Drugs. C.N.S. stimulants.

2. Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs, Narcotic analgesics and antagonists.

3. **Pharmacology of Cardiovascular System:** General considerations, Digitals and cardiac glycosides, Antihypertensive drugs, Antianginal and Vasodilator drugs. Antiarrhythmic drugs.

4. **Drugs Acting on the Hemopoietic System:** Hematinics, Antihyperlipidemic drugs. Drugs used in the therapy of shock. Anticoagulants, Vitamin K and hemostatic agents.

5. **Drugs Acting on the Respiratory System:** Anti-asthmatic drugs including bronchodilators. Antitussives and expectorants. Respiratory stimulants.

510 – Pharmaceutical Microbiology – II

(THEORY)

1. Introduction and the scope of microbiology, Structure of bacterial cell, Classification of microbes and their taxonomy, Bacteria and Viruses.

2. Identification of Microbes, stains and types of staining techniques, Preparation and sterilization of media Nutrition, cultivation, isolation of bacteria and viruses, Microbial genetics and variation.

3. Control of microbes by physical and chemical methods.
   (a) Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
   (b) Sterilization, different methods, validation of sterilization methods & equipments.

4. Sterility testing of Pharmaceutical products as per Indian Pharmacopoeia, Microbial assays of Antibiotics & Vitamins, Immunity, primary and secondary, defensive mechanisms of body, microbial resistance, interferon.

5. Aseptic techniques: Sources of contamination and methods of prevention, designing of aseptic area, laminar flow equipment, its services and maintenance.

6. Microbial assay of antibiotics and vitamins.

B. PHARM. (6th SEMESTER)

601 – Pharmaceutical Chemistry-VI

1. Drug metabolism: General pathway of drug metabolism including different Types of read ion in phase-I and Phase-II with examples, factors affecting drug metabolism including stereo chemical aspects, significance of drug metabolism in medicinal chemistry.

2. The following topics shall cover structure, nomenclature classification, synthesis, SAR and metabolism of drugs official in I.P. & B.P.

(i) Cholinergic agent (Parasympathomimetics)
(ii) Cholinergic blocking agents (Parasympatholytics)
(iii) Adrenoceptor stimulants (Sympathomimetics)
(iv) Adrenoceptor blocking agents (Sympatholytics)
(v) Drugs affecting uterine motility
(vi) Local anaesthetic drugs
(vii) Anticoagulant and antiplatalet drugs.
(viii) Antihistaminics.

603 – Pharmaceutical Technology-II

1. **Micro-encapsulation:** Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-acervation, multi orifice, spray drying, spray congealing, polymerization, complex emulsion, air suspension technique, coating pan and other techniques.

2. **Liquid Dosage Forms:** Introduction, additives used in formulations - Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors and flavours. Manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

3. **Parentaral Products:** Preformulation factors, route of administration, water for injection, pyrogenicity, non aqueous vehicles, isotonicity, methods of adjustment, preparation and evaluation of parentrals.

4. **Surgical Products:** Definition, primary wound dressing, absorbents, surgical cotton, surgical gauzes etc., bandages, adhesive tape, protective cellulosic homeostasis, official dressing, absorbable and non absorbable sutures, ligature and catguts.

5. **Ophthalamic preparations:** Requirements, formulation, methods of preparation, containers and evaluation.

1. Systematic study of source, cultivation, collection, processing, chemical constituents, substitutes, adulterants, uses, macroscopy, microscopy and special chemical test of the following alkaloid containing drugs:

Pyridine-Piperidine: Areca, Lobelia and Tobacco.
Tropane: Belladonna, Hyoscyamus, Datura and withania.
Quinoline and Isoquinoline: Cinchona, Opium, Ipecac.
Indole: Ergot, Rauwolfia, catharanthus, Nux vomica.
Imidazole: Pilocarpus.
Steroidal: Kurchi.
Alkaloidal amines: Ephedra and Colchicum.
Glycoalkaloids: Solanum.
Purines: Coffee, Tea, Cola.

2. Chromatography: Introduction, classification, study TLC, Column, Paper and Electrophoresis chromatographic methods and their application in evaluation of herbal drugs.
3. Biogenetic investigations of basic metabolic pathways. Breif introduction to biogenesis of secondary metabolites of pharmaceutical importance.
4. Extraction, isolation and chemistry of Glycoside, Lignans, Quassinoids, Flavonoids, Alkaloids and Terpenoids.

605 – Pharmacognosy-IV

607 – Pharmacology-III

1. **Drugs Acting on the Gastrointestinal Tract:** Antacids, Anti secretory and Anti-Ulcer drugs. Laxatives and Antidiarrhoeal drugs. Appetite Stimulants and Suppressants. Emetics and Anti-emetics.Miscellaneous – Carminatives, Demulcents, Protectives, Adsorbents, Astringents, Digestants, Enzymes and Mucolytics.
2. **Pharmacology of Endocrine System:** Hypothalamic and pituitary hormones. Thyroid hormones and Anti Thyroid drugs, Parathormone, Calcitonin and Vitamin D. Insulin, Oral Hypoglycemic agents & Glucagon. ACTH and Corticosteroids. Androgens and Anabolic steroids. Estrogens, Progesterone and Oral Contraceptives. Drugs acting on the uterus.
3. **Chemotherapy:** General Principles of Chemotherapy. Sulfonamides and Clotrimoxazole. Antibiotics- Penicillins, Cephalosporins, Chloramphenicol, Erythromycin and Miscellaneous Antibiotics. Quinolones. Chemotherapy of Tuberculosis, Leprosy, Fungal diseases, Viral diseases. Urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy and Immunosuppressive Agents.
4. Gene expression, regulation and gene mapping.
5. **Gene therapy:** Clinical application of gene therapy, disease target for gene therapy, pharmacokinetic and pharmacodynamic consideration for gene therapy.

609 – Forensic Pharmacy & Ethics

1. Historical Background:
   a) Drug legislation in India
   b) Code of Ethics for Pharmacists
2. Pharmacy Act
3. Drug Laws (as amended up to date):
   a) Drugs and cosmetic Act
   b) Narcotic Drugs and Psychotropic substance Act, and Rules
   c) Drugs and Magic Remedies (Objectionable Advertisements) Act
   d) Medicinal and Toilet Preparations (Excise Duties) Act, Rules
4. Prevention of Cruelty to Animals Act including CPCSEA guidelines
5. Medical termination of pregnancy Act
6. The D: ; (price control) Order
7. AICTE Act
8. Patent Act
9. Factory Act
10. Poison Act

611 – Drug Regulatory Affairs

1. Requirement of Current Good Manufacturing Practices (CGMP).
2. Requirement of Good Laboratory Practices (GLP).
3. Brief review on USFDA guidelines (General drug approval process)
4. The WHO Guidelines – Relevance in international registration.
5. Overview of ISO 9000 Application to Drug and Medical Devices.
6. Documentation- Protocols, Forms and Maintenance of Records in Pharmaceutical Industries, New Drug Approval and Export Registration.
7. Processing and its application Intellectual property rights (Patents, Copy rights and Trademarks).
8. Sewage disposal and Pollution control.

Books and Reference Recommended:

1. Willing, Tuckerman and Hitching, Good Manufacturing Practice for Pharmaceuticals.
2. Bharatha, Drugs and Pharmacy Laws in India.
3. Banker G.S. and Rhodes C.T. Modern Pharmaceutics.
4. Indian Pharmacopoeia
5. British Pharmacopoeia.
6. United States Pharmacopoeia.

B. PHARM. (7th SEMESTER)

(1907-701) – Pharmaceutical Chemistry-VII

The following topics shall cover structure, nomenclature classification, synthesis, SAR and metabolism of drugs official in IP & B.P

(i) Sedatives & hypnotics (Including SAR in barbiturates)
(ii) Anticonvulsants
(iii) Neurolepties (Including SAR in Phenothiazines)
(iv) Antidepressants
(v) Anxiolytics
(vi) General anaesthetics
(vii) Diagnostic agents
(viii) Preparation, storage and care of Radiopharmaceuticals
(ix) Vitamins and hormones
(x) Analgesics: Morphine, codeine, Nalorphine Naloxone, meperidine hydrochloride, Methadone hydrochloride. (with SAR in Morphine)
(xi) NSAIDS

(1907-702) – Pharmaceutics-VII

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

2. Biopharmaceutics :
   i. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis)
   ii. Factors influencing absorption- physicochemical, physiological and pharmaceutical.
   iii. Drug distribution in the body, plasma protein binding.

3. Pharmacokinetics:
   (a) Significance of plasma drug concentration measurement.
   (b) Compartment model definition and scope.
   (c) Volume of distribution and distribution coefficient.
   (d) Compartment kinetics- one compartment and two compartment model. Determination of pharmacokinetics parameters from plasma and urine data after drug administration by intravascular and oral route, rate constant using Wagner- Nelson and Loo Reigelman method.
   (e) Curve fitting (method of residuals), regression procedure.
   (f) Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance.
   (g) Extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation.

4. Clinical Pharmacokinetics: Definition and scope, Dosage adjustment in patients with and without renal and hepatic failure, Pharmacokinetics drug interaction and their significance in combination therapy.

5. Bioavailability And Bioequivalence: Factors affecting bioavailability of drugs, protocol for bioavailability testing, statistical treatment of data.

6. Measure of bioavailability Cmax, Tmax and area under the curve (AUC).

(1907-703) – Pharmaceutical Biotechnology

- **Introduction:** Brief review on history of biotechnology; traditional and modern biotechnology; biotechnology as an interdisciplinary area; terminologies used in biotechnology; global impact of biotechnology on healthcare.

2. **Recombinant DNA technology:** Chemical and Physical nature of DNA; General principles of DNA replication; tools and techniques of genetic engineering, site directed mutagenesis, polymerase chain reaction and analysis of DNA sequences, gene library; Advantages of producing biotechnological products by recombinant means, Plants and transgenic animals as potential sources of recombinant biotechnological products, Study of biotechnology drugs such as human insulin, Interferons, Human growth hormone, Hepatitis B vaccines, Erythropoietin etc.

3. **Gene Therapy:** brief concept; viral and non viral gene delivery systems; applications in treatment of single gene disorders such as Cystic fibrosis, ADA etc.

4. **Immunology and immunological preparation:** Introduction to immunology: antigen, antibodies, cells and organs of immune system; active and passive immunity; Antigen-antibody reactions and their applications; hypersensitivity; Immunological tolerance; Classification, preparations, standardization and storage of immunologicals: vaccines, antisera, toxoids etc. New generation vaccines such as sub-unit vaccines, DNA vaccines etc.

5. **Hybridoma technology:** Formation and selection of hybrid cells, principles and productions of monoclonal antibodies, commercial, production, characterization, quality control and storage of monoclonal antibodies. Advantages and applications of monoclonal antibodies

(1907-704) – Pharmacology-IV

1. **Principles of Toxicology:** Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning, Heavy metals and heavy metal antagonists. Definition of acute, sub acute and chronic toxicity. Genotoxicity and carcinogenicity, teratogenecity and mutagenecity studies. Applications of isolated organ techniques in toxicology. Techniques in membrane toxicology. Applications of pharmacokinetics in toxicology. Role of analytical toxicology in poisoning management, toxicovigilance and prevention of poisoning.
2. **OECD guidelines for toxicity studies of chemicals.**
3. **Free radicals pharmacology:** Generation of free radicals, role of free radicals in etiopathology of various diseases. Protective activity of certain important antioxidants.
4. **Drug interactions, their types and prevention of drug interaction. Rationale for drug combination.**
5. **Chronopharmacology:** Definition of rhythms and cycles. Biological clock and their significance leading to chronotherapy.

(1907-705) – Pharmaceutical Industrial Management

1. Concept of management: Administrative management (Planning Organizing, Staffing, Directing and Controlling), Entrepreneurship development and operative management, (Personnel, Materials, Production, Financial, Marketing). Principles of management (Co-ordination, communication, motivation, decision-making, leadership, innovation, creativity, delegation of authority, responsibility, record keeping).

2. Pharmaceutical Marketing: Function, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, department store, multiple shops and mail order business.

3. Salesmanship: Principles of sales promotion, advertising, ethics of sales merchandising, literature, detailing, recruitment, training, evaluation and compensation to the pharmacist.

4. Human resource management (HRM): Human resource planning, recruitment and interviewing, human skills evaluation through various instruments, job description, job evaluation, role clarity, career planning.

5. Management of Industrial relations: Industrial disputes, settlement of disputes through various routes as bargaining.

6. Productivity and operation management: Productivity concepts, problems, tools and techniques for improvement.

7. Marketing concepts, and analyzing marketing opportunities, marketing strategy, market segmentation, understanding the product and its market, product positioning, launching product, understanding the product manager role, market research, global marketing management.

(1907-706A) – Bioavailability & Therapeutic Drug Monitoring

1. Principles of Drug Dissolution Related to Bioavailabilit ; Dissolution Rate, Diffusion Laws, Idea of *in vitro* and *in vivo* correlation and its significanc .
2. Explanation of terms: Bioavailability (Absolute and Rel tive), Bioequivalence and clinical and therapeutic equivalence, pharmaceutical alternative; Purpose and methods of bioavailability studies using blood level and urinary excretion data, Protocol Requirements.
3. Definition of Pharmacokinetics and introduction to different pharmacokinetic parameters, such as rate constants for absorption and elimination, half-life, apparent volume of distribution, clearance, steady state plasma drug concentration, factors affecting it. Calculation of Dosage regimen.
4. Therapeutic Drug Monitoring – Individualization of need based Dose regimen; Design of Dosage regimen; Pharmacokinetic evaluation of drug interactions, readjustment of dosage regimen, clinical examples.

Suggested books: Latest editions of-

01. "Modern Pharmaceutics", G.S.Banker and C.T.Rhodes, Marcel Dekker Inc., NY.
02. J.G.Wagner – Fundamentals of Clinical Pharmacokinetics, Drug Intelligence Publications, Hamilton, PA, USA.

(1907-706B) – Drug Design

1. Principles of Drug Design (Theoretical Aspect), Traditional analog and molecular approaches.
2. Quantitative Structure-activity relationship (QSAR) study.
   (a) Objectives and Limitation of Quantitative Structure-activity relationship.
   (b) QSAR Parameters
   (c) QSAR Methods
   (d) Substituent constants
   (e) Linear relationship between Log P and Biological activity
   (f) Non-Linear relationship between Log P and Biological activity
   (g) Steric substituent constants
3. Introduction to Graph theory, Applications and Quantum mechanics, Computer aided Drug Designing and Molecular Modeling.
4. Preliminary idea of Quantitative Structure Pharmacokinetic relationship (QSPR) in Drug Design.

Suggested books: Latest editions of-

01. C.Hanch, Comprehensive Medicinal Chemistry, Vol. IV, Quantitative Drug Design, Pergamon Press, Oxford, U.K.

B. PHARM. (8th SEMESTER)

(1908-801) – Pharmaceutical Chemistry-VIII

1. Drug Design: Principles of drug design including QSAR.
2. Structure Activity Relationship and drug design
3. Analog approach, mechanism based drug design
4. Brief introduction to computer aided drug design.
5. Discovery and development of new drugs: Random screening, Molecular manipulation, serendipity. Role of preclinical & clinical evaluation in drug development.
6. Prodrugs: Basic concepts and application of prodrug design.
7. The following topics shall cover structure, nomenclature, classification, synthesis, SAR and metabolism of drugs official in I.P. & B.P.

(i) Sulphonamides
(ii) Anti-tubercular drugs
(iii) Antimalarial drugs
(iv) Antiprotozoal drugs
(v) Antiviral drugs
(vi) Anticancer drugs
(vii) Antibiotics
(viii) Anthelmintic drugs

(1908-802) – Pharmaceutical Analysis-III

The students should be made well acquainted with the use of following techniques as applied to assay of drugs in quality assurance programme.

1. **Ultraviolet and Visible Spectrophotometry:** Electromagnetic Radiation (EMR), laws of photochemistry, Single and double beam instruments and applications.
2. **Infrared Spectroscopy:** Principle, Instrumentation, sample handling and applications.
3. **Nuclear Magnetic Resonance Spectroscopy:** Principle, chemical shift, coupling, Instrumentation & applications, brief Introduction to ^{13}C-NMR.
4. **Mass Spectroscopy-** Principle, Fragmentation rules, Instrumentation and applications.
5. **Polarography:** Principle, Instrumentation & Applications.
6. **Atomic Absorption and Emission Spectroscopy:** Principle, relationship between atomic absorption and flame emission spectroscopy, Instrumentation, Interferences & applications.
7. **Fluorimetry:** Fluorescence and Phosphorescence, Instrumentation and applications.
8. **Electron Spin Resonance Spectroscopy:** Principle and applications of ESR.

(1908-803) – Pharmaceutics-VIII

1. Preformulation studies

(I) Study of physical properties of drugs like physical form, polymorphism, solubility, salt formation, dissolution and partitioning effects and their influence on formulation, stability and bioavailability of products.

(II) Study of chemical properties like hydrolytic degradation, oxidation, racemization, decarboxylation, polymerization and their influence on formulation and stability of products. Drug substance – excipient interaction study.

2. New Drug Delivery Systems

Importance, Formulation and Applications:

(I) Transdermal Drug Delivery Systems: Concept, Advantages and disadvantages, Approaches used in developing Transdermal drug delivery systems, *in vitro* evaluation of Transdermal drug delivery systems.

(II) Liposomes: Formulation, Preparation of liposomes-physical dispersion and solvent dispersion, Characterisation of Liposomes, Applications in Pharmacy.

(III) Occular Drug Delivery Systems: Concept, Advantages and disadvantages, Mucoadhesives, design of Occuserts (Pilo 40 and Pilo 20), Erodable inserts.

(IV) Nanoparticles : A brief introduction to Nanoparticle technology and Nanoparticles as drug carriers in controlled & targeted drug delivery systems.

3. Blood Products and Plasma Substitutes

Classification of blood products; collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin foam, plasma substitute, ideal requirements and large scale preparation of dextran.

4. Cosmetics

(I) Hair care products: Introduction, hair structure, shampoos, conditioners, setting lotion, hair creams, bleaches and hair dyes

(II) Skin care products : Introduction, anatomy and physiology of skin, formulation of skin cleaners, creams, lotions, moisturizers, sun screen products and acne products.

(III) Color cosmetics: Introduction, lip colors, nail polish, face make up and eye make up.

(IV) Dental products: Dentrifices, oral rinses, tooth powder and tooth paste.

(1908-804) – Pharmacognosy-V

(1908-805) – Pharmacology-V

1. **Introduction to Clinical Pharmacy:** Development and scope of clinical pharmacy in India, concept of health care team, role of clinical pharmacist as a member of health care team and his/her important functions.
2. **Basic Concepts of Pharmacotherapy:** Recording of medication history, self medication, nonprescription drug usage, improving patient compliance and providing patient counseling, Clinical Pharmacokinetics and Individualization of Drug Therapy. Drug use during Infancy and in the Elderly (Pediatrics & Geriatrics), Drug use during Pregnancy. Drug induced Diseases. The basics of Drug Interactions, General Principles of Clinical Toxicology, Interpretation of Clinical Laboratory Tests.
3. **Important Disorders of Organ Systems and their Management:** Cardiovascular Disorders – Hypertension, Congestive Heart Failure, Angina, Acute Myocardial Infarction, Cardiac arrhythmias, CNS Disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression, Respiratory Disease – Asthma, Gastrointestinal Disorders – Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis, Endocrine Disorders – Diabetes mellitus and Thyroid disorders, Infectious Diseases – Tuberculosis, Urinary Tract Infection, Enteric Infections, Upper Respiratory Infections.
4. **Therapeutic Drug Monitoring.**
5. **Concept of Essential Drugs and Rational Drug use.**
6. **Drugs and poison information centers.**
7. **Communication skills, behavioral and interpersonal, with patients and other professional.**

(1908-806) – Project

(1908-807) – Quality Assurance