FACULTY OF LIFE SCIENCES

SYLLABUS

for

BACHELOR OF PHARMACY
(Credit Based Evaluation & Grading System)

(Semester: I - VI) As per PCI Rules for New Students

(Semester: VII-VIII) For Old Students

Examinations: 2019-20

GURU NANAK DEV UNIVERSITY
AMRITSAR

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Defaulters will be prosecuted.

(ii) Subject to change in the syllabi at any time.
Please visit the University website time to time.
New syllabus for the Bachelor of Pharmacy Degree Program as recommended by Pharmacy Council of India (PCI) implemented w.e.f. session 2017-18.

<table>
<thead>
<tr>
<th>Course code</th>
<th>Name of the course</th>
<th>Lecture (L)</th>
<th>Tutorial (T)</th>
<th>Practical</th>
<th>Credit points</th>
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Total Credit 31½/32

*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.

Candidates who did not pass Biology subject in entry qualification (+2 Sc. Etc.) examination are required to take Remedial Biology (T&P), and those who did not pass Mathematics subject are required to take Remedial Mathematics.

Candidates who passed both Biology and Mathematics subjects will take Remedial Biology (T&P BP106RBT & BP112RBP) or Remedial Mathematics (BP106RMT) on basis he/she admitted for course.

Note:  
1. *Special Paper in lieu of Punjabi Compulsory  
2. **For those students who are not domicile of Punjab  
3. ***Student can opt this Paper whether in 1st or 2nd Semester.
BACHELOR OF PHARMACY (SEMESTER SYSTEM)
(Credit Based Evaluation & Grading System)

Tables: Scheme for Internal Assessment

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<tr>
<th>Course code</th>
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<th>Continuous Mode</th>
<th>Internal Assessment</th>
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Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB) course.
Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM) course.
* Non University Examination (NUE)
### SEMESTER-II

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**Note-1.**
1. *Special Paper in lieu of Punjabi Compulsory*
2. **For those students who are not domicile of Punjab*
3. ***Student can opt this Paper whether in 1st or 2nd Semester.***

**Note-2.**
(1) Lecture/Tutorials: One Lecture Hour Per Week = One Credit.
(2) Practical: Two Hrs. Per Week = One Credit.
### Tables: Scheme for Internal Assessment

#### Semester-II

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* The subject experts at college level shall conduct examinations

**Note:** PSL-053 ID Course Human Rights & Constitutional Duties (Compulsory Paper). Students can opt. this paper in any Semester except the 1st Semester. This ID Paper is one of the total ID Papers of this course.
BACHELOR OF PHARMACY (SEMESTER SYSTEM)
(Credit Based Evaluation & Grading System)

Question paper pattern for theory Sessional examinations

For subjects having University examination

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Question paper pattern for end semester theory examinations

For 75 marks paper

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For 50 marks paper

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**BACHELOR OF PHARMACY (SEMESTER SYSTEM)**
(Credit Based Evaluation & Grading System)

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**Question paper pattern for end semester practical examinations**

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# BACHELOR OF PHARMACY (SEMESTER SYSTEM)
## (Credit Based Evaluation & Grading System)

### SEMESTER-III

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**Total Credits**: 24

**Note**:  
(1) Lecture/tutorial: One lecture hour per week = One Credit  
(2) Practical: two hours per week = One Credit
Tables: Scheme for Internal Assessment

### Semester III

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### BACHELOR OF PHARMACY (SEMESTER SYSTEM)
(credit Based Evaluation & Grading System)

**SEMESTER--IV**

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**Total Credits** 28

**Note:**
(1) Lecture/Tutorials: One lecture hour per week = One Credit.
(2) Practical: Two Laboratories per week = One Credit.
### Tables: Scheme for Internal Assessment

#### Semester IV

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**Total** 27 5 26

**Note:**

1. Lecture/Tutorials: One Lecture Hour Per Week = One Credit.
2. Practical: Two Hrs. Per Week = One Credit.
# Tables: Scheme for Internal Assessment

**B Pharmacy Semester-V**

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BACHELOR OF PHARMACY (SEMESTER SYSTEM)  
(Credit Based Continuous Evaluation Grading System)

**SEMESTER-VI**

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Note:  
(1) Lecture/Tutorials: One Lecture Hour Per Week = One Credit.  
(2) Practical: Two Hrs. Per Week = One Credit.
## Tables: Scheme for Internal Assessment

**B Pharmacy Semester-VI**

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Total 75 120 18 Hrs 195 555 30 Hrs 750
## BACHELOR OF PHARMACY (SEMESTER SYSTEM)

### SEMESTER-VII

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*Interdisciplinary Course(s) | | | | 08

**Total Credits** 27.5

**Note:**
1. Lecture/tutorial: One lecture hour per week = One credit
2. Practical: two hours per week = One credit
3. PSL-053 ID Course Human Rights & Constitutional Duties (Compulsory Paper)
   Students can opt. this paper in any odd semester. This ID Paper is one of the total ID Papers of this course.
## BACHELOR OF PHARMACY (SEMESTER SYSTEM)

(Credit Based Continuous Evaluation Grading System)

## SEMESTER-VIII

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**Total Credits** 22.5

**Note:** Lecture/tutorial: One lecture hour per week = One credit
Practical: two hours per week = One credit
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. Perform the various experiments related to special senses and nervous system.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Appreciate coordinated working pattern of different organs of each system

Course Content:

Unit I

1. 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.

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

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

Unit II

1. Integumentary system
   Structure and functions of skin

2. 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

3. Joints
   Structural and functional classification, types of joints movements and its articulation
Unit III

1. **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.

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

Unit IV

4. **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.

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

Unit V

6. **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)  
2 Credits (0-0-2)  
4 Hours/week

Practical physiology is complimentary to the theoretical discussions in physiology. Practical’s 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).
15. Recording of blood pressure.

Recommended Books (Latest Editions)

3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
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
3 Human Physiology (vol 1 and 2) by Dr. C.C. Chatterjee, Academic Publishers Kolkata
BP102T. PHARMACEUTICAL ANALYSIS (Theory)

4 Credits (3-1-0)
45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

1. carryout various volumetric and electrochemical titrations
2. 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
      Primary and secondary standards.
      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

1. 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

2. Non aqueous titration: Solvents, acidimetry and alkaliometry titration and
   estimation of Sodium benzoate and Ephedrine HCl

UNIT-III

10 Hours

1. Precipitation titrations: Mohr’s method, Volhard’s, Modified, Volhard’s,
   Fajans method, estimation of sodium chloride.
2. **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.


4. Basic Principles, methods and application of diazotisation titration.

**UNIT-IV**

1. **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**

1. **Conductometry** - Introduction, Conductivity cell, Conductometric titrations, application

2. **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.

3. **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications
BP108P. PHARMACEUTICAL ANALYSIS (Practical)

2 Credits (0-0-2)
4 Hours / Week

I  Limit Test of the following
   a. Chloride
   b. Sulphate
   c. Iron
   d. 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)

2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.
BP103T. PHARMACEUTICS- I (Theory)

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:

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

Course Content:

UNIT – I

10 Hours

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

2. **Dosage forms**: Introduction to dosage forms, classification and definitions

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

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

UNIT – II

10 Hours

1. **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.

3. **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**
  1. **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
  2. **Biphasic liquids:**
  3. **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
  4. **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**
  1. **Suppositories:** Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
  2. **Pharmaceutical incompatibilities:** Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

**UNIV – V**

- **07 Hours**
  1. **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)  

2 Credits (0-0-2)  
2 Hours / week

1. **Syrups**  
   a. Syrup IP  
   b. Paracetamol pediatric syrup

2. **Elixirs**  
   a) Piperazine citrate elixir  
   b) Paracetamol pediatric elixir

3. **Linctus**  
   a) Simple Linctus BPC

4. **Solutions**  
   a) Strong solution of ammonium acetate  
   b) Cresol with soap solution

5. **Suspensions**  
   a) Calamine lotion  
   b) Magnesium Hydroxide mixture

6. **Emulsions**  
   a) Turpentine Liniment  
   b) Liquid paraffin emulsion

7. **Powders and Granules**  
   a) ORS powder (WHO)  
   b) Effervescent granules  
   c) Dusting powder

8. **Suppositories**  
   a) Glycerol gelatin suppository  
   b) Soap glycerin suppository

9. **Semisolids**  
   a) Sulphur ointment  
   b) Non staining iodine ointment with methyl salicylate  
   c) Bentonite gel

10. **Gargles and Mouthwashes**  
    a) Potassium chlorate gargle  
    b) Chlorhexidine mouthwash
Recommended Books: (Latest Editions)

2. Carter S.J., Cooper and Gunn’s-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
9. E.A. Rawlins, Bentley’s Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY  
(Theory)

4 Credits (3-1-0) 
45 Hours 
Max. Marks: 75 
Internal Assessment: 25 
Total Marks: 100

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

Objectives: Upon completion of course student shall be able to

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

Course Content:

UNIT I

10 Hours

1. Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate 
2. 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

1. 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. 
2. 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. 
3. Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.
UNIT III

1. **Gastrointestinal agents**

   **Acidifiers:** Ammonium chloride* and Dil. HCl

   **Antacid:** Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

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

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

UNIT IV

1. **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

1. **Radiopharmaceuticals:** Radio activity, Measurement of radioactivity, Properties of $\alpha$, $\beta$, $\gamma$ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide $^{131}$, Storage conditions, precautions & pharmaceutical application of radioactive substances.
BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

2 Credits (0-0-2)
4 Hours / Week

1. **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

1. **Identification test**
   - Magnesium hydroxide
   - Ferrous sulphate
   - Sodium bicarbonate
   - Calcium gluconate
   - Copper sulphate

1. **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)**

2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
7. Indian Pharmacopoeia
BP105T.COMMUNICATION SKILLS (Theory)

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


2. Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers


UNIT – II
07 Hours

5. Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication

UNIT – III

07 Hours

1 Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations

2 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

3 Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV

05 Hours

1 Interview Skills: Purpose of an interview, Do’s and Don’t’s of an interview

2 Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT – V

04 Hours

1 Group Discussion: Introduction, Communication skills in group discussion, Do’s and Don’t’s of group discussion
BP111P.COMMUNICATION SKILLS (Practical)  

2 Hours / week

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

**Basic communication covering the following topics**
- Meeting People
- Asking Questions
- Making Friends
- What did you do?
- Do’s and Don’t’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)**
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
BP 106RBT.REMEDIAL BIOLOGY (Theory)

2 Credits (2-0-0)
30 Hours
Max. Marks: 35
Internal Assessment: 15
Total Marks: 50

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
1. know the classification and salient features of five kingdoms of life
2. understand the basic components of anatomy & physiology of plant
3. know understand the basic components of anatomy & physiology animal with special reference to human

UNIT I 07 Hours

Living world:
1. Definition and characters of living organisms
2. Diversity in the living world
3. Binomial nomenclature
4. Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering plants
γ. Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.

UNIT II 07 Hours

Body fluids and circulation
1. Composition of blood, blood groups, coagulation of blood
2. Composition and functions of lymph
3. Human circulatory system
4. Structure of human heart and blood vessels
5. Cardiac cycle, cardiac output and ECG
Digestion and Absorption

1. Human alimentary canal and digestive glands
2. Role of digestive enzymes
3. Digestion, absorption and assimilation of digested food

Breathing and respiration

1. Human respiratory system
2. Mechanism of breathing and its regulation
3. Exchange of gases, transport of gases and regulation of respiration
4. Respiratory volumes

UNIT III

Excretory products and their elimination

1. Modes of excretion
2. Human excretory system- structure and function
3. Urine formation
4. Rennin angiotensin system

Neural control and coordination

1. Definition and classification of nervous system
2. Structure of a neuron
3. Generation and conduction of nerve impulse
4. Structure of brain and spinal cord
5. Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation

1. Endocrine glands and their secretions
2. Functions of hormones secreted by endocrine glands

Human reproduction

1. Parts of female reproductive system
2. Parts of male reproductive system
3. Spermatogenesis and Oogenesis
4. Menstrual cycle
UNIT IV

Plants and mineral nutrition:
1. Essential mineral, macro and micronutrients
2. Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

UNIT V

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

Plant growth and development
1. Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators

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

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

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

Reference Books
1. A Text book of Biology by B.V. Sreenivasa Naidu
2. A Text book of Biology by Naidu and Murthy
3. Botany for Degree students By A.C. Dutta.
5. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate
BP112RBP.REMEDIAL BIOLOGY (Practical)

1 Credits (0-0-1)
30 Hours

1 Introduction to experiments in biology
   1.1 Study of Microscope
   1.2 Section cutting techniques
   1.3 Mounting and staining
   1.4 Permanent slide preparation
2 Study of cell and its inclusions
3 Study of Stem, Root, Leaf and its modifications
4 Detailed study of frog by using computer models
5 Microscopic study and identification of tissues
6 Identification of bones
7 Determination of blood group
8 Determination of blood pressure
9 Determination of tidal volume

Reference Books

BACHELOR OF PHARMACY (SEMESTER-I)
(Credit Based Evaluation & Grading System)

BP 106RMT.REMEDIAL MATHEMATICS (Theory)

2 Credits (2-0-0)
30 Hours
Max. Marks: 35
Internal Assessment: 15
Total Marks: 50

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

Objectives: Upon completion of the course the student shall be able to:
1) Know the theory and their application in Pharmacy
2) Solve the different types of problems by applying theory
3) Appreciate the important application of mathematics in Pharmacy

Course Content:

UNIT – I
06 Hours

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

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

3. **Function**: Real Valued function, Classification of real valued functions

4. **Limits and continuity**:
   - Introduction, Limit of a function, Definition of limit of a function \((\varepsilon - \delta)\)
   - \(\lim_{{x \to a}} \frac{x^n - a^n}{x - a} = na^{n-1}\), \(\lim_{{\theta \to 0}} \frac{\sin\theta}{\theta} = 1\)

UNIT –II
06 Hours

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

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

UNIT – IV  
06 Hours

- **Analytical Geometry**
  - **Introduction**: Signs of the Coordinates, Distance formula,
  - **Straight Line** : Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line
  - **Integration**: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

UNIT-V  
06 Hours

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

**Recommended Books (Latest Edition)**

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
3. Integral Calculus by Shanthinarayan
4. Higher Engineering Mathematics by Dr.B.S.Grewal
BACHELOR OF PHARMACY (SEMESTER-I)
(Credit Based Evaluation & Grading System)

PBL 121: प्लाज्मी रक्तमणि - I (Credit Based)
Credit: 2-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

अंब-ईंधन अध्ययन

1. पृथक भंडार दें त्वचा ब्लूक देओ। उद्य भंड घर दिए दे भूमि भंड दें लग्नो।
2. भूमि भंडे हैं, इतना भूमि बंदू रहे। उद भंडा दिए दिल भूमि रक्तमणि है। भूमि भंड बिने है जबा दिए जीणा सा सह भंड दें।
3. उदेश भूमि दे चक्षुस भंड दें।
4. एक्ष्य बैट लगाव में 100 भूमि सी टूट भंड भंड दें दें दें दें दें दें दें दें दें दें दें दें दें दें दें दें दें दें दें दें दें दें।

पेपर-1

I. दे मेज (मेंप, उल्कित मिश्र मिलें, पूल मिश्र महत्वपूर्ण)
बूत दरवर टिंद पुश्टियों की, अभियुक्त मिलें टेक दिन दिल बनहीं लगी:
(ए) साँप वाली मिश्र
(भ) पाली तम तांति
(ब) मुँह पुरूष मिश्र

II. भूमि भंड कर्न (तीव्रता-ज्यादा, मध्यम भंड दें चर्चा हिमिता हृदि) : 10 वेंद्र विधिपुरुष
(वालम विध क्ष क्ष वाल रक्तर अभिनव)

पेपर-2

I. दे मेज (मेंप, उल्कित मिश्र मिलें, पूल मिश्र महत्वपूर्ण)
ताल दरवर टिंद पुश्टियों की, अभियुक्त मिलें टेक दिन दिल बनहीं लगी:
(ए) टेक भूमि भंडू शुष्कपत्र
(भ) अभियुक्त पूल
(ब) बुरी वाली मिश्र

II. में, आधार: दिन लाख दिन आधार स्वृध दें दें दें विचार
(15 वेंद्र दे मेंप आधार अधिनव विधिपुरुष)

पेपर-3

I. दे मेज (मेंप, उल्कित मिश्र मिलें, पूल मिश्र महत्वपूर्ण)
ताल दरवर टिंद पुश्टियों की, अभियुक्त मिलें टेक दिन दिल बनहीं लगी:
(ए) साँप वाली घटानी
(भ) मुँह पुरूष भंडू

II. अध्यायी दिनांकरण: दिनों, रक्तमणि दें मध्यम म्युफिलियों राश भंड क्षेत्र
PBL-122: भाषाकी पंजाबी
(In lieu of Punjabi Compulsory)

Credits: 2-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

अंतर्दोष भबन पालीका समीक्षा उपक्रमित

1. पुस्तक पेशव दे चल जगा गेहुँ। उन जगा दिखें दे पुरस्त पूंढ़े गहोँ।
2. दिखिएलारी दे बेंच पूरा पुरस्त चलते गहोँ। उन जगा दिखें देवी पूरा सपाटी धे।
3. पुस्तक पूरा किये ही जगा दिखें दीवार ना समर्पण धे।
4. भेंट फैंट चलत राक्ष सेवत चरो उन पुरस्त दी एंड में दें चल रान दूर-पुरस्त दिखें जव मसर्प धे।

पठ-चूर्ण

मेवालश-छे

पाइ अंगिन, अंगिन बुध,
भारती (भारती नाट-प्रचार)
खजापत (खिटी दिली, अंगिन) : पहड़ दे देंगे

मेवालश-की

पुणेशी मसात महादुः : पुणेशी नाट-प्रचार
मापात मसात, मापात मसात, मापात मसात
भूस मसात, भूस मसात भदेलिजी

मेवालश-मी

मूंण भामें : हिंदे पैंते दिखें भामें मसात हुँ मूंण चलता
मापातुपय दे हिंदेपलब मसात

मेवालश-दी

उदं दे मूंण दिखें दे लां, बावूं भवीनियां दे लां, दुंड़ं दे राम, दिख दे मैं उंग बिठडी मसात दिखें।
HSL-101: Punjab History & Culture (1450-1716)
(Special paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)

Credits: 2-0-0
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A
1. Land and the People.
2. Bhakti Movement

Section-B
3. Life and Teaching of Guru Nanak Dev.

Section-C
5. Guru Hargobind.
6. Martyrdom of Guru Teg Bahadur

Section-D

Suggested Reading
SOA-101: DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY ID COURSE)
(Student can opt. this paper whether in 1st or 2nd Semester)

PROBLEM OF DRUG ABUSE

Time: 3 Hours
Credit 3-0-0

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section – A

Meaning of Drug Abuse:
2) Consequences of Drug Abuse for:
   Individual : Education, Employment, Income.
   Family : Violence.
   Society : Crime.
   Nation : Law and Order problem.

Section – B

Management of Drug Abuse:
(i) Medical Management: Medication for treatment and to reduce withdrawal effects.
(ii) Psychiatric Management: Counselling, Behavioural and Cognitive therapy.
(iii) Social Management: Family, Group therapy and Environmental Intervention.

Section – C

Prevention of Drug Abuse:
(i) Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.
(ii) School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

Section – D

Controlling Drug Abuse:
(i) Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program
References:

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

4 Credits (3-1-0)  
45 Hours  
Max. Marks: 75  
Internal Assessment: 25  
Total Marks: 100

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

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

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

Course Content:

Unit I  
10 hours

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

Unit II  
06 hours

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

  **Unit III**
  10 hours

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

• **Urinary system**

  **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)

2 Credits (0-0-2)

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.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

Recommended Books (Latest Editions)

3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
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
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterjee, Academic Publishers Kolkata
BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

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*
SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP^2 hybridization in alkenes
E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff’s orientation, free radical addition reactions of alkenes, Anti Markownikoff’s orientation.
Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement
UNIT-III  

- **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, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT-IV  

- **Carbonyl compounds*** (Aldehydes and ketones)
  Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

UNIT-V  

- **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)

2 Credits (0-0-2)
4 Hours / week

1. Systematic qualitative analysis of unknown organic compounds like

   i) Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
   ii) Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne’s test
   iii) Solubility test
   v) Melting point/Boiling point of organic compounds
   vi) Identification of the unknown compound from the literature using melting point/ boiling point.
   vii) Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
   viii) 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
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.
BP203 T. BIOCHEMISTRY (Theory)

4 Credits (3-1-0)
45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

**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

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

2. **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**

- **Carbohydrate metabolism**
  - Glycolysis – Pathway, energetics and significance
  - Citric acid cycle- Pathway, energetics and significance
  - HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency
  - Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance
  - Hormonal regulation of blood glucose level and Diabetes mellitus
• **Biological oxidation**
  
  Electron transport chain (ETC) and its mechanism.  
  Oxidative phosphorylation & its mechanism and substrate level phosphorylation  
  Inhibitors ETC and oxidative phosphorylation/Uncouplers

**UNIT III**

10 Hours

• **Lipid metabolism**
  
  - β-Oxidation of saturated fatty acid (Palmitic acid)
  - Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid)
  - Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D
  - Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

• **Amino acid metabolism**
  
  - General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders
  - Catabolism of phenylalanine and tyrosine and their metabolic disorders (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

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

07 Hours
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)

4. Biochemistry by D. Satyanarayan and U. Chakrapani
7. Outlines of Biochemistry by Conn and Stumpf
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.
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:**

- **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
BACHELOR OF PHARMACY (SEMESTER-II)
(Credit Based Evaluation & Grading System)

Unit III

- **Haematological Diseases:**
  Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia
- **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormone
- **Nervous system:** Epilepsy, Parkinson’s disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer’s disease.
- **Gastrointestinal system:** Peptic Ulcer

Unit IV

- 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

- **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.
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].
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey;
10. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.


**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)

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

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

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

Course content:

UNIT – I

06 hours

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

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

UNIT – II

06 Hours

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

UNIT – III

06 hours

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

Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System
UNIT – IV

06 hours

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

UNIT-V

06 hours

Computers as Data Analysis in Preclinical Development: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)
BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

1 Credits (0-0-1)

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.
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):

2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
BACHELOR OF PHARMACY (SEMESTER-II)  
(Credit Based Evaluation & Grading System)

PBL 131 : बैचलर फार्मासिया - II (Credit Based)

Credit : 2-0-0
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

1. धूमधार पेंटेने चार जना गेलींग। उन जन्ना दिचें ने पुतला पुंडी नाथंग।
2. विनिमयजीवी तें बंद धारी पुतला जतेंग उठा। उन जन्ना दिचें दिच पुतला लाभानी झे। पैसें धूमधार दिक्के बंद जन्ना दिचे बोंड ना संभव हे।
3. गेलू धूमधार दें घगगड़ भंडार उठा।
4. धूलए मंडळ बल्को नीतिन बने उं पुतलां ठी बंद करीं धांप्त उं धांप्त घुरे। पुतलां धुरू-धुरू लिच वत संभव हे।

मैमार-टैंग

I. देव चेहरा (मुख्य, उपनिषद मिथ मिथ, धूमधार मिथ मधोपीयाना)
बाबू राजकुमार जोशी, अभिप्राय मिथ मिथ धर प्रदेश : [१] टाभा मिथ मिथ : भिक्षा
[२] जुलू मिथ मिथ मधोपीयाना : बैली पी दी
[३] मादू मिथ मिथ : भिक्षा दें फिकारे
(कुंजीवाला ए सीडेल, बौद्ध मात, दिसम-सुझ, बौद्ध बल्क)

II. बैचलर मंडळ घटनां : पान-पान, कोड (प्रतिभा, फिकेट, फिकेटउप अरु काँगारी), सभामार

मैमार-बीँग

I. देव चेहरा (मुख्य, उपनिषद मिथ मिथ, धूमधार मिथ मधोपीयाना)
बाबू राजकुमार जोशी, अभिप्राय मिथ मिथ धर प्रदेश : [१] अगस्त मिथ मिथ : भिक्षा
[२] बाबू मिथ मिथ धर : त्रिजी धार त अधिशा
(कुंजीवाला ए सीडेल, बौद्ध मात, दिसम-सुझ, बौद्ध बल्क)

II. धूमधार पुतलां : वलाम दिच १० दिचों (अधिशा, बौद्ध मात, अहमद अरु उपमान्य) के पेश उपचारे दे अधिशा

मैमार-भीँग

I. देव चेहरा (मुख्य, उपनिषद मिथ मिथ, धूमधार मिथ मधोपीयाना)
बाबू राजकुमार जोशी, अभिप्राय मिथ मिथ धर प्रदेश : [१] बदलेंड मिथ मिथ धर : यात्री तेजला धारला
[२] तुडू मिथ मिथ : भिक्षा क्वाले वर्ती गाथी
[३] पैसें भुलाम : भिक्षा
(कुंजीवाला ए सीडेल, बौद्ध मात, दिसम-सुझ, बौद्ध बल्क)

II. भुपते दे मधार (भक्ति दे भुपते कंप दिच) २०० भुपते अरु १०० मधार टू झांस दिच कुलमार टू भक्ति दे मधार

मैमार-बीँग

I. देव चेहरा (मुख्य, उपनिषद मिथ मिथ, धूमधार मिथ मधोपीयाना)
बाबू राजकुमार जोशी, अभिप्राय मिथ मिथ धर प्रदेश : [१] भैमी वती : धूम मिथम
[२] ठाडेर वती टिटार : घौल वांञ्चल
(कुंजीवाला ए सीडेल, बौद्ध मात, दिसम-सुझ, बौद्ध बल्क)

II. मधार मेंटीन्या : रहू, पुतला, फिकेटउप, बिलिङ्ग, बिलिङ्ग फिकेटउप, मंदिर
BACHELOR OF PHARMACY (SEMESTER-II)
(Credit Based Evaluation & Grading System)

PBL-132: ਪੁਣਿਆਂਂ (In lieu of Punjabi Compulsory)

Credits: 2-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage
HSL-102: Punjab History & Culture (1717-1947)
(Special paper in lieu of Punjabi Compulsory)
(For those students who are not domicile of Punjab)

Credits: 2-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A
1. Sikh Struggle for Sovereignty.
2. Ranjit Singh: Conquests, Administration and the Anglo-Sikh Relations.

Section-B
3. Anglo-Sikh Wars and the Annexation.

Section-C
5. Economic Changes: Agricultural

Section-D
8. Fairs and Festivals.

Suggested Reading
SOA-101 : DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION
(COMPULSORY ID COURSE)
(Student can opt. this paper whether in 1st or 2nd semester)

PROBLEM OF DRUG ABUSE

Time: 3 Hours
Credit 3-0-0

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section – A
Meaning of Drug Abuse:
2. Consequences of Drug Abuse for:
   Individual : Education, Employment, Income.
   Family : Violence.
   Society : Crime.
   Nation : Law and Order problem.

Section – B
Management of Drug Abuse:
(iv) Medical Management: Medication for treatment and to reduce withdrawal effects.
(v) Psychiatric Management: Counselling, Behavioural and Cognitive therapy.
(vi) Social Management: Family, Group therapy and Environmental Intervention.

Section – C
Prevention of Drug Abuse:
(iii) Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.
(iv) School: Counselling, Teacher as role-model. Parent-teacher-Health Professional Coordination, Random testing on students.

Section – D
Controlling Drug Abuse:
(iii) Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program
References:

1. Ahuja, Ram (2003), Social Problems in India, Rawat Publication, Jaipur.
BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

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

UNIT IV 08 Hours
Polynuclear hydrocarbons:
   a. Synthesis, reactions
   b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene,
      Diphenylmethane, Triphenylmethane and their derivatives

UNIT V
   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

Recommended Books (Latest Editions)
   1. Organic Chemistry by Morrison and Boyd
   2. Organic Chemistry by I.L. Finar, Volume-I
   4. Organic Chemistry by P.L. Soni
   5. Practical Organic Chemistry by Mann and Saunders.
   8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
Scope: The course deals with the various physical and physicochemical properties and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon the completion of the course student shall be able to
1. Understand various physicochemical properties of drug molecules in designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing & 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

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


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

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

UNIT-IV


UNIT-V

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

**Recommended Books: (Latest Editions)**

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar
Study of all categories of microorganisms especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc..

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

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

Course content:

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

Unit II
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
Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses.
Classification and mode of action of disinfectants
Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions
Evaluation of bactericidal & Bacteriostatic.
Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.
Unit IV  
08 Hours
Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.
Assessment of a new antibiotic.

Unit V  
07 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.

Recommended Books (Latest edition)

5. Rose: Industrial Microbiology.
7. Cooper and Gunn’s: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
BP 304T. PHARMACEUTICAL ENGINEERING (Theory)

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 tests 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

- **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
BACHELOR OF PHARMACY (SEMESTER-III)
(Credit Based Evaluation & Grading System)

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.

UNIT-IV 08 Hours
- **Centrifugation**: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT- V 07 Hours
- **Materials of pharmaceutical plant construction, Corrosion and its prevention**: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

**Recommended Books: (Latest Editions)**
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
1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co-efficient of benzoic acid in benzene and water
4. Determination of Partition co-efficient of Iodine in CCl4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method
BP 307P. PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hrs/week

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
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
BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/week

1. Determination of radiation constant of brass, iron, unpainted and painted glass.
2. Steam distillation – To calculate the efficiency of steam distillation.
3. To determine the overall heat transfer coefficient by heat exchanger.
5. Determination of moisture content and loss on drying.
7. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, dehumidifier.
8. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.
9. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger’s, Bond’s coefficients, power requirement and critical speed of Ball Mill.
10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.
11. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/viscosity)
12. To study the effect of time on the Rate of Crystallization.
1. To calculate the uniformity Index for given sample by using Double Cone Blender.
ESL-220: ENVIRONMENTAL STUDIES  
(COMPULSORY ID COURSE)  

Credits: 4-0-0

Teaching Methodologies
The Core Module Syllabus for Environmental Studies includes classroom teaching and field work. The syllabus is divided into 8 Units [Unit-I to Unit-VII] covering 45 lectures + 5 hours for field work [Unit-VIII]. The first 7 Units will cover 45 lectures which are classroom based to enhance knowledge skills and attitude to environment. Unit-VIII comprises of 5 hours field work to be submitted by each candidate to the Teacher in-charge for evaluation latest by 15 December, 2019.

Exam Pattern:
End Semester Examination- 75 marks  
Project Report/Field Study- 25 marks [based on submitted report]  
Total Marks- 100

The structure of the question paper being:

Part-A, Short answer pattern with inbuilt choice – 25 marks
Attempt any five questions out of seven distributed equally from Unit-I to Unit-VII. Each question carries 5 marks. Answer to each question should not exceed 2 pages.

Part-B, Essay type with inbuilt choice – 50 marks
Attempt any five questions out of eight distributed equally from Unit-I to Unit-VII. Each question carries 10 marks. Answer to each question should not exceed 5 pages.

Project Report / Internal Assessment:

Part-C, Field work – 25 marks [Field work equal to 5 lecture hours]
The candidate will submit a handwritten field work report showing photographs, sketches, observations, perspective of any topic related to Environment or Ecosystem. The exhaustive list for project report/area of study are given just for reference:

1. Visit to a local area to document environmental assets: River / Forest/ Grassland / Hill / Mountain / Water body / Pond / Lake / Solid Waste Disposal / Water Treatment Plant / Wastewater Treatment Facility etc.
2. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
3. Study of common plants, insects, birds
4. Study of tree in your areas with their botanical names and soil types
5. Study of birds and their nesting habits
6. Study of local pond in terms of wastewater inflow and water quality
7. Study of industrial units in your area. Name of industry, type of industry, Size (Large, Medium or small scale)
8. Study of common disease in the village and basic data from community health centre
9. Adopt any five young plants and photograph its growth
10. Analyze the Total dissolved solids of ground water samples in your area.
11. Study of Particulate Matter (PM_{2.5} or PM_{10}) data from Sameer website. Download from Play store.
12. Perspective on any field on Environmental Studies with secondary data taken from Central Pollution Control Board, State Pollution Control Board, State Science & Technology Council etc.

Unit-I
The multidisciplinary nature of environmental studies
Definition, scope and importance, Need for public awareness
(2 lectures)

Unit-II
Natural Resources: Renewable and non-renewable resources:
Natural resources and associated problems.
(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

(8 Lectures)

Unit-III
Ecosystems
- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

(6 Lectures)

Unit-IV
Biodiversity and its conservation
- Introduction – Definition: genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity
Environmental Pollution
Definition
- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

Social Issues and the Environment
- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

Human Population and the Environment
- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies
Field Work
- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-pond, river, hill slopes, etc

(Field work equal to 5 lecture hours)

References:
2. Down to Earth, Centre for Science and Environment, New Delhi.
9. State of India’s Environment 2018 by Centre for Sciences and Environment, New Delhi
BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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
Stereo isomerism
10 Hours
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
Geometrical isomerism
10 Hours
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.
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)

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

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

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

UNIT- I

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

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*, Phenolamine, Phenoxybenzamine, Prazosin, Dihydropregotamine, Methysergide.

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, Isofluoraphate, Ethocharophate iodide, Parathion, 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, chlorzepate, Lorazepam, Alprazolam, Zolpidem
- Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

**Miscellaneous:**
- Amides & imides: Glutethimide.
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
**Miscellaneous**: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V

**07 Hours**

**Drugs acting on Central Nervous System**

**General anesthetics:**
Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.
Ultra short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.
Dissociative anesthetics: Ketamine hydrochloride.*

**Narcotic and non-narcotic analgesics**
Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride,

Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.
Narcotic antagonists: Nalorphine hydrochloride, Levallophan tartarate, Naloxone hydrochloride.
Recommended Books (Latest Editions)

2. Foye’s Principles of Medicinal Chemistry.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington’s Pharmaceutical Sciences.
6. Martindale’s extra pharmacopoeia.
9. Indian Pharmacopoeia.
BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

45Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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 and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:
UNIT-I
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
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
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
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


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.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.
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  
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  
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  
4. Pharmacology of drugs acting on central nervous system  
   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.  

Recommended Books (Latest Editions)  
3. Goodman and Gilman’s, The Pharmacological Basis of Therapeutics  
5. Mycek M.J, Gelnret S.B and Perper M.M. Lippincott’s Illustrated Reviews-Pharmacology  
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher  
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,  
10. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
BP 405 T.PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)  45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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:
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

**Pharmacognosy in various systems of medicine:**

UNIT IV 10 Hours
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

**Recommended Books: (Latest Editions)**
3. Text Book of Pharmacognosy by T.E. Wallis
7. Essentials of Pharmacognosy, Dr.SH.Anrari, 1Ind edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs by M.A. Iy

**BP406P. MEDICINAL CHEMISTRY – I (Practical)**
A. 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

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

III Determination of Partition coefficient for any two drugs
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
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.
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.
15. Study of local anesthetics by different methods.

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos.
BP409 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4 Hours/Week

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

BP501T. MEDICINAL CHEMISTRY – II (Theory)
4 Credits (3-1-0) 45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

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

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

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

UNIT- I 10 Hours

**Antihistaminic agents:** Histamine, receptors and their distribution in the human body

**H1-antagonists:** Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylhydramine hydrochloride, Tripelennamine hydrochloride, Chlorgyline hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Tripelennamine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetirazine Cromolyn sodium

**H2-antagonists:** Cimetidine*, Famotidine, Ranitidin.

**Gastric Proton pump inhibitors:** Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic agents:

**Alkylating agents:** Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepe

**Antimetabolites:** Mercaptourpune*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

**Antibiotics:** Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

**Plant products:** Etoposide, Vinblastin sulphate, Vincristin sulphate

**Miscellaneous:** Cisplatin, Mitotane
UNIT – II 10 Hours

**Anti-anginal:**

**Vasodilators:** Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.

**Calcium channel blockers:** Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

**Diuretics:**
Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamidine.
Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,
Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.
Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.
Osmotic Diuretics: Mannitol

**Anti-hypertensive Agents:** Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III 10 Hours

**Anti-arrhythmic Drugs:** Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorca

**Anti-hyperlipidemic agents:** Clofibrate, Lovastatin, Cholesteramine and Cholestipol

**Coagulant & Anticoagulants:** Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

**Drugs used in Congestive Heart Failure:** Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.

UNIT- IV 08 Hours

**Drugs acting on Endocrine system**

Nomenclature, Stereochemistry and metabolism of steroids

**Sex hormones:** Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.

**Drugs for erectile dysfunction:** Sildenafil, Tadalafil.

**Oral contraceptives:** Mifepristone, Norgestrel, Levonorgestrol

**Corticosteroids:** Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone

**Thyroid and antithyroid drugs:** L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.
UNIT – V

07 Hours

Antidiabetic agents:
Insulin and its preparations
Glucosidase inhibitors: Acrabose, Voglibose.
Local Anesthetics: SAR of Local anesthetics
Benzoic Acid derivatives: Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.
Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.
Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.
Miscellaneous: Phenacaine, Diperodon, and Dibucaine.*

Recommended Books (Latest Editions)

2. Foye’s Principles of Medicinal Chemistry.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington’s Pharmaceutical Sciences.
6. Martindale’s extra pharmacopoeia.
9. Indian Pharmacopoeia.
BP 502T. Industrial Pharmacy I (Theory)

4 Credits (3-1-0)  45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

Objectives: Upon completion of the course the student shall be able to
1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course content:

UNIT-I  07 Hours

Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances.

a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization

BCS classification of drugs & its significant

Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

UNIT-II  10 Hours

Tablets:


b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.

c. Quality control tests: In process and finished product tests

Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia
UNIT-III 08 Hours

**Capsules:**


**Pellets:** Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets

UNIT-IV 10 Hours

**Parenteral Products:**

a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity

b. Production procedure, production facilities and controls, aseptic processing

c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products.

d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

**Ophthalmic Preparations:** Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

UNIT-V 10 Hours

**Cosmetics:** Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

**Pharmaceutical Aerosols:** Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.

**Packaging Materials Science:** Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.
BP 506 P. Industrial Pharmacy I (Practical)

2 Credits (0-0-2)

4 Hours/week

1. Preformulation studies on paracetamol/asparin/or any other drug
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Quality control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman & J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
BP503T. PHARMACOLOGY-II (Theory)

4 Credits (3-1-0)  45 Hours

Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

Objectives: Upon completion of this course the student should be able to
1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Course Content:

UNIT-I  10 hours
1. Pharmacology of drugs acting on cardio vascular system
   a. Introduction to hemodynamic and electrophysiology of heart.
   b. Drugs used in congestive heart failure
   c. Anti-hypertensive drugs.
   d. Anti-anginal drugs.
   e. Anti-arrhythmic drugs.
   f. Anti-hyperlipidemic drugs.

UNIT-II  10 hours
1. Pharmacology of drugs acting on cardio vascular system
   a. Drug used in the therapy of shock.
   b. Hematinics, coagulants and anticoagulants.
   c. Fibrinolytics and anti-platelet drugs
   d. Plasma volume expanders
2. Pharmacology of drugs acting on urinary system
   a. Diuretics
   b. Anti-diuretics.

UNIT-III  10 hours
3. Autocoids and related drugs
   a. Introduction to autacoids and classification
   b. Histamine, 5-HT and their antagonists.
   c. Prostaglandins, Thromboxanes and Leukotrienes.
   d. Angiotensin, Bradykinin and Substance P.
   e. Non-steroidal anti-inflammatory agents
   f. Anti-gout drugs
   g. Antirheumatic drugs
UNIT-IV 08 hours

5. Pharmacology of drugs acting on endocrine system
   a. Basic concepts in endocrine pharmacology.
   b. Anterior Pituitary hormones- analogues and their inhibitors.
   c. Thyroid hormones- analogues and their inhibitors.
   d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.
   e. Insulin, Oral Hypoglycemic agents and glucagon.
   f. ACTH and corticosteroids.

UNIT-V 07 hours

5. Pharmacology of drugs acting on endocrine system
   a. Androgens and Anabolic steroids.
   b. Estrogens, progesterone and oral contraceptives.
   c. Drugs acting on the uterus.

6. Bioassay
   a. Principles and applications of bioassay.
   b. Types of bioassay.
   c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT.
BP 507 P. PHARMACOLOGY-II (Practical)

2 Credits (0-0-2)
4 Hours/week

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
12. Determination of PD2 value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
15. Analgesic activity of drug using central and peripheral methods

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

**Recommended Books (Latest Editions)**

3. *The Pharmacological Basis of Therapeutics*, The Point Lippincott Williams & Wilkins.
BP504T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

4 Credits (3-1-0)  45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

Objectives: Upon completion of the course, the student shall be able
1. to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
2. to understand the preparation and development of herbal formulation.
3. to understand the herbal drug interactions
4. to carry out isolation and identification of phytoconstituents

Course Content:

UNIT-I  7 Hours
Metabolic pathways in higher plants and their determination
a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II  14 Hours
General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,
Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta
Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis
Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,
Tannins: Catechu, Pterocarpus
Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony
Glycosides: Senna, Aloes, Bitter Almond
Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III  06 Hours
Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisin
b) Glycosides: Glycyrrhetinic acid & Rutin
c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine
d) Resins: Podophyllotoxin, Curcumin

UNIT-IV  10 Hours
Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT V

8 Hours

Basics of Phytochemistry
Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.
BP 508P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

2 Credits (0-0-2)

4 Hours/week

1. Morphology, histology and powder characteristics & extraction &
detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel
and Coriander
2. Exercise involving isolation & detection of active principles
   a. Caffeine - from tea dust.
   b. Diosgenin from Dioscorea
   c. Atropine from Belladonna
   d. Sennosides from Senna
3. Separation of sugars by Paper chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii)
   Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)
1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B.
   Publishers & Distribution, New Delhi.
   Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla
   publications, New Delhi, 2007
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers,
   New Delhi, 2005.
10. The formulation and preparation of cosmetic, fragrances and flavours.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey
BP 505T. PHARMACEUTICAL JURISPRUDENCE (Theory)
4 Credits (3-1-0)   45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

Objectives: Upon completion of the course, the student shall be able to understand:
1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
2. Various Indian pharmaceutical Acts and Laws
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. The code of ethics during the pharmaceutical practice

Course Content:
UNIT-I 10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945:
Objectives, Definitions, Legal definitions of schedules to the Act and Rules
Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.
Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,
Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II 10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945.
Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.
Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, licensing authorities, controlling authorities, Drugs Inspectors
UNIT-III

10 Hours

- **Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties


- **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV

08 Hours

- **Study of Salient Features of Drugs and Magic Remedies Act and its rules**: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

- **Prevention of Cruelty to animals Act-1960**: Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

- **National Pharmaceutical Pricing Authority**: Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V

07 Hours

- **Pharmaceutical Legislations** – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

- **Code of Pharmaceutical ethics** Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist’s oath

- **Medical Termination of Pregnancy Act**

- **Right to Information Act**

- **Introduction to Intellectual Property Rights (IPR)**

Recommended books: (Latest Edition)
1. Forensic Pharmacy by B. Suresh
2. Text book of Forensic Pharmacy by B.M. Mithal
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
BP601T. MEDICINAL CHEMISTRY – III (Theory)
4 Credits (3-1-0)  45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

Objectives: Upon completion of the course student shall be able to
1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Course Content:

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

UNIT – I  10 Hours

Antibiotics
Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.
β-Lactam antibiotics: Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams
Aminoglycosides: Streptomycin, Neomycin, Kanamycin
Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II  10 Hours

Antibiotics
Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.
Macrolide: Erythromycin Clarithromycin, Azithromycin.
Miscellaneous: Chloramphenicol*, Clindamycin.
Prodrugs: Basic concepts and application of prodrugs design.
Antimalarials: Etiology of malaria.
Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.
Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.
Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovoquone.
UNIT – III  
10 Hours

**Anti-tubercular Agents**

*Synthetic anti-tubercular agents:* Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*

*Anti-tubercular antibiotics:* Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycine sulphate.

**Urinary tract anti-infective agents**

*Quinolones:* SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciproflaxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin

*Miscellaneous:* Furazolidine, Nitrofurantoin*, Methanamine.


UNIT – IV  
08 Hours

**Antifungal agents:**

*Antifungal antibiotics:* Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

*Synthetic Antifungal agents:* Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.


**Sulphonamides and Sulfones**

Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfoisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulframethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

*Folate reductase inhibitors:* Trimethoprim*, Cotrimoxazole.

*Sulfones:* Dapsone*.

UNIT – V  
07 Hours

**Introduction to Drug Design**

Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet’s electronic parameter, Tafts steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques.

*Combinatorial Chemistry:* Concept and applications chemistry: solid phase and solution phase synthesis of combinatorial
BP607P. MEDICINAL CHEMISTRY- III (Practical)

2 Credits (0-0-2)
4 Hours/week

I Preparation of drugs and intermediates

1. Sulphanilamide
2. 7-Hydroxy, 4-methyl coumarin
3. Chlorobutanol
4. Triphenyl imidazole
5. Tolbutamide
6. Hexamine

II Assay of drugs

1. Isonicotinic acid hydrazide
2. Chloroquine
3. Metronidazole
4. Dapsone
5. Chlorpheniramine maleate
6. Benzyl penicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

Recommended Books (Latest Editions)

2. Foye’s Principles of Medicinal Chemistry.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington’s Pharmaceutical Sciences.
6. Martindale’s extra pharmacopoeia.
9. Indian Pharmacopoeia.
BP602 T. PHARMACOLOGY-III (Theory)
4 Credits (3-1-0)  45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

Objectives: Upon completion of this course the student should be able to:
1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. comprehend the principles of toxicology and treatment of various poisonings and
3. Appreciate correlation of pharmacology with related medical sciences.

Course Content:

UNIT-I 10 hours

1. Pharmacology of drugs acting on Respiratory system
   a. Anti-asthmatic drugs
   b. Drugs used in the management of COPD
   c. Expectorants and antitussives
   d. Nasal decongestants
   e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract
   a. Antiulcer agents.
   b. Drugs for constipation and diarrhoea.
   c. Appetite stimulants and suppressants.
   d. Digestants and carminatives.
   e. Emetics and anti-emetics.

UNIT-II 10 hours

3. Chemotherapy
   a. General principles of chemotherapy.
   b. Sulfonamides and cotrimoxazole.
   c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides

UNIT-III 10 hours

3. Chemotherapy
   a. Antitubercular agents
   b. Antileprotic agents
   c. Antifungal agents
d. Antiviral drugs 
e. Anthelmintics  
f. Antimalarial drugs  
g. Antiamoebic agents

UNIT-IV 08hours

3. Chemistry  
a. Urinary tract infections and sexually transmitted diseases. 
b. Chemotherapy of malignancy.

4. Immunopharmacology  
a. Immunostimulants  
b. Immunosuppressant  
Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V 07hours

5. Principles of toxicology  
a. Definition and basic knowledge of acute, subacute and chronic toxicity.  
b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity  
c. General principles of treatment of poisoning  
d. Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning.

6. Chronopharmacology  
a. Definition of rhythm and cycles.  
b. Biological clock and their significance leading to chronotherapy.
BP 608 P. PHARMACOLOGY-III (Practical)

2 Credits (0-0-2)
4 Hours/week

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi-autoanalyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology (student’s t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

*Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

3. Goodman and Gilman’s, The Pharmacological Basis of Therapeutics
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott’s Illustrated Reviews-Pharmacology
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
BP 603T. HERBAL DRUG TECHNOLOGY (Theory)
4 Credits (3-1-0)  45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

Objectives: Upon completion of this course the student should be able to:
1. understand raw material as source of herbal drugs from cultivation to herbal drug product
2. know the WHO and ICH guidelines for evaluation of herbal drugs
3. know the herbal cosmetics, natural sweeteners, nutraceuticals
4. appreciate patenting of herbal drugs, GMP.

Course content:
UNIT-I
11 Hours
Herbs as raw materials
Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation Source of Herbs Selection, identification and authentication of herbal materials processing of herbal raw material

Biodynamic Agriculture
Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine
a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy
b) Preparation and standardization of Ayurvedic formulations viz. Aristas and Asawas, Ghutika, Churna, Lehya and Bhasma.

UNIT-II
7 Hours
Nutraceuticals
General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.
Study of following herbs as health food: Alfalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypericum, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.
UNIT-III  10 Hours

**Herbal Cosmetics:** Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

**Herbal excipients:** Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

**Herbal formulations:** Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

UNIT- IV  10 Hours

**Evaluation of Drugs** WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.

**Patenting and Regulatory requirements of natural products:**

a) Definition of the terms: Patent, IPR, Farmers right, Breeder’s right Bioprospecting and Biopiracy

b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

**Regulatory Issues** - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

UNIT-V  07 Hours

**General Introduction to Herbal Industry**

Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

**Schedule T – Good Manufacturing Practice of Indian systems of medicine**

Components of GMP (Schedule – T) and its objective Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.
BP 609 P. HERBAL DRUG TECHNOLOGY (Practical)

1. To perform preliminary phytochemical screening of crude drugs.
2. Determination of the alcohol content of Asava and Arista
3. Evaluation of excipients of natural origin
4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr. S. H. Ansari
5. Pharmacognosy & Phytochemistry by V. D. Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS  
(Theory)  
4 Credits (3-1-0)  
45 Hours  
Max. Marks: 75  
Internal Assessment: 25  
Total Marks: 100

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

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

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

Course Content:

UNIT-I  
10 Hours

Introduction to Biopharmaceutics
Absorption: Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes,

Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

UNIT- II  
10 Hours

Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

UNIT- III  
10 Hours

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, one compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - $K_E$, $t_{1/2}$,Vd, AUC, Ka, Cl_t and CL_R- definitions methods of eliminations, understanding of their significance and application
UNIT- IV 08 Hours

**Multicompartment models:** Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.

UNIT- V 07 Hours

**Nonlinear Pharmacokinetics:**
- c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

**Recommended Books: (Latest Editions)**

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
5. Pharmacokinetics: By Milo Gibaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
**P605T. PHARMACEUTICAL BIOTECHNOLOGY (Theory)**

4 Credits (3-1-0) 45 Hours

Max. Marks: 75

Internal Assessment: 25

Total Marks: 100

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

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

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

**Unit I** 10 Hours

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.

b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.

c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.

d) Brief introduction to Protein Engineering.

e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.

f) Basic principles of genetic engineering.

**Unit II** 10 Hours

a) Study of cloning vectors, restriction endonucleases and DNA ligase.

b) Recombinant DNA technology. Application of genetic engineering in medicine.

c) Application of r DNA technology and genetic engineering in the production of:

i) Interferon
ii) Vaccines- hepatitis-B
iii) Hormones-Insulin.

d) Brief introduction to PCR
Unit II 10 Hours
Types of immunity- humoral immunity, cellular immunity
a) Structure of Immunoglobulins
b) Structure and Function of MHC
c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
e) Storage conditions and stability of official vaccines
f) Hybridoma technology- Production, Purification and Applications
g) Blood products and Plasma Substitutes.

Unit IV 08 Hours
a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.
b) Genetic organization of Eukaryotes and Prokaryotes
c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
d) Introduction to Microbial biotransformation and applications.
e) Mutation: Types of mutation/mutants.

Unit V 07 Hour
a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
b) Large scale production fermenter design and its various controls.
c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,
d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.

Recommended Books (Latest edition):
2. RA Goldshy et. al., : Kuby Immunology.
BP606T PHARMACEUTICAL QUALITY ASSURANCE (Theory)

4 Credits (3-1-0) 45 Hours
Max. Marks: 75
Internal Assessment: 25
Total Marks: 100

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

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

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

Course content:

UNIT – I 10 Hours
Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP
Total Quality Management (TQM): Definition, elements, philosophies
ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines
Quality by design (QbD): Definition, overview, elements of QbD program, tools
ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration
NABL accreditation: Principles and procedures

UNIT – II 10 Hours
Organization and personnel: Personnel responsibilities, training, hygiene and personal records. Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

UNIT – III 10 Hours
Quality Control: Quality control test for containers, rubber closures and secondary packing materials.

UNIT IV 08 Hours
Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.

Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT V 07 Hours

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP’s – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Deckker Series
   ICH guidelines, ISO 9000 and 14000 guidelines
BACHELOR OF PHARMACY (SEMESTER-VII)
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PHL157: MEDICINAL CHEMISTRY-II

3 Credits (2-1-0)


2. Pharmaceutical Chemistry (Source/ synthesis, Structure, stereochemistry, physicochemical properties, Structure activity relationships. Mode of action and Applications) of the following classes of drugs:
   (c) Local Anaesthetics: Nervous tissue, Mechanism of action of local anaesthetics Products.
   (g) Diagnostic agents: Radioopaque diagnostic agents. Agents for kidney function test. Agents for liver function tests. Miscellaneous diagnostic agents.
Books Recommended (Latest editions unless specified):


2. W.C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA


1 **Preformulation Studies**: Organoleptic properties, purity, particle size, shape, surface area, solubility and dissolution of drugs. Chemical reactions involving drug excipient interactions, solid state stability studies.

2 **Parenteral Technology**: Preformulation factors, water for injection, pyrogenicity, non-aqueous vehicles, isotonicity and its adjustment methods, emulsions and suspension formulations as parenteral and their formulation. Containers i.e. glass composition and its suitability, test for alkalinity, plastics container Closures i.e. natural and synthetic rubber and quality control of closures. Pre-filling treatment i.e. washing of containers and closures, preparation of small volume and large volume parenterals. Quality control test for SVP and LVP.

3 **Pharmaceutical Aerosols**: Components, formulation, types of systems, manufacturing, operation of an aerosol package, quality control and testing, oral inhalation nasal and topical aerosols.

4 **Controlled Drug Delivery Systems**: Introduction, terminology and drug targeting. Physiochemical and biological factors influencing design and performance of sustained release products. Design and fabrication of oral controlled release drug delivery system. Introduction to liposomes, microspheres, endocytosis of macromolecular drug carriers, implantable and transdermal therapeutic systems. Commonly used polymers in controlled drug delivery systems.

5 **Packaging Technology**: Types of containers, materials used for packaging and their interaction with drugs, closures, unit dose packaging and strip packaging materials. Packaging of solid, parenterals and ophthalmic dosage forms. Tamper proof packaging.


7 **Dissolution testing of solid dosage forms**: In vitro- In vivo correlation and BCS classification of drugs
Books Recommended (Latest editions unless specified):


PHL159: Pharmaceutical Management

3 Credits (2-1-0)

1. **Concept of Management**: Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale). Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, Innovation, Creativity, Delegation of Authority / Responsibility, Record Keeping).


3. **Materials management**: Materials handling, equipment, inventory management, economic ordering quantity (EOQ), ABC analysis, value analysis, classification and codification of stores, obsolete, surplus and scrap management, lead time, inventory carrying costs, safety stock.

4. **Pharmaceutical Marketing**: Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.

5. **Salesmanship**: Principle of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, Recruitment, training, evaluation, compensation to the pharmacist.


7. **Management of hospital pharmacy**
   a) Introduction to health care systems in India and abroad, health services and hospital Pharmacy, recommendations of various committees and commissions.
   b) Pharmacist’s role in administration, dispensing/ manufacturing, quality control, Pharmacy therapeutic committee Hospital formulary and provisioning of drugs in hospitals. Principles of stores management, establishment of central and sub stores in hospitals, centralized and decentralized stores, Precautions of storage of drugs, receipts and issue, OTC products.
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Recommended Books (Latest editions unless specified):

1. Introduction to the antimicrobial therapy
2. Chemotherapeutic Agents Part- I
   2.1. Beta-lactam and other cell-wall & membrane-active antibiotics
   2.2. Tetracyclins, macrolides, chloramphenicol & streptogramins
   2.3. Aminoglycosides & spectinomycin
   2.4. Sulfonamides, trimethoprim & quinolones
3. Chemotherapeutic Agents Part- II
   3.1. Antimycobacterial agents
   3.2. Antifungal agents
   3.3. Antiprotozoal agents
   3.4. Antiviral agents
4. Cancer chemotherapy
5. Immunopharmacology
7. Drug therapy of inflammatory disorders: Disease modifying antirheumatic agents (DMARDs), Gout and Inflammatory Bowel disease

**Recommended Books (Latest editions unless specified):**

PHL161: Pharmaceutical Biotechnology

3 Credits (2-1-0)

1. Introduction to pharmaceutical Biotechnology: concepts, basic techniques of biotechnology (such as ELISA, Western blot, Southern blot and Northern blot) and their application in pharmacy, biotechnology industry, products, application of bioreactors for large scale production of useful pharmaceutical products and markets.

2. Genetic recombination: Transformation, conjugation, transduction, protoplast fusion, gene cloning and their applications, Development of hybridoma for monoclonal antibodies, study of drugs produced by biotechnology such as Activase, Humulin, streptokinase, Hepatitis B etc.


4. Immunology & Immunological preparation: Principles, antigens and haptens, immune system, cellular humoral immunity, immunological tolerance, antigen antibody reaction and their applications, hypersensitivity, active and passive immunization, vaccines, their preparation, standardization and dosages.

5. Enzyme immobilization: Techniques of immobilization of enzymes and cells, factors affecting enzyme kinetics. Applications in pharmaceutical industry, therapeutics and clinical assays.


7. Design of drug delivery system for biotechnological products.

Recommended Books (Latest editions unless specified):
1. Vyas and Dixit Pharmaceutical Biotechnology, 1st CBS Publisher, New Delhi, 1991
PHP 162: Pharmaceutical Technology II

1.5 Credits (0-0-1.5)

EXPERIMENTS:

1. Experiments based on preparation, characterization and quality control test for tablet, capsules, suspension, emulsion and parenteral dosage forms.
2. Experiments based on preformulation studies of drugs.
3. Experiments based on dissolution testing of immediate release and controlled release dosage forms.
4. Experiments based quality control test for packaging materials.
5. Preparation, characterization and quality control test for tablet, capsules, suspension, emulsion and parenteral dosage forms.
6. Industrial Tour

NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.
1 Study of toxicity with antimicrobials: Gentamycin induced nephropathy, isoniazid induced peripheral neuropathy etc.
2 Study of drugs useful for inflammatory conditions.
3 Study of drugs with memory enhancing action.
4 Application of statistical analysis using t-test etc.

Animal studies will be supplemented with simulated experiments with software’s wherever available.

Books Recommended: (Latest editions unless specified):

BACHELOR OF PHARMACY (SEMESTER-VII)
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**PHP 164: Pharmaceutical Biotechnology**

**1.5 Credits (0-0-1.5)**

**EXPERIMENTS:**
1. Preparation of Nutrient Media
2. Preparation of plant cell culture media
3. Aseptic Technique and the Transfer of Microorganisms
4. Culture Techniques
   a. Liquid Media Inoculation
   b. Solid Media Inoculation like Streak plate, Pour plate, Stab culture, Swab culture.
5. To isolate the micro-organism from sample of water.
6. Isolation of DNA and its purity estimation
7. Estimation of DNA by Diphenylamine Method
8. To prepare hydrated synthetic seeds in-vitro
9. Isolation of RNA and its purity estimation
10. Enzyme immobilization by Ca-alginate method.
11. To isolate protoplast by mechanical method
12. Separation of green plant pigments by column chromatography
13. Spectrophotometric assay of enzymes
14. Estimation of
   a. Serum Glutamate Oxaloacetate Transaminase (SGOT) Test
   b. Serum Glutamate Pyruvate Transaminase (SGPT) Test
   c. Protein with standard curve by Ninhydrine method
15. Effect of Substrate Concentration on Enzyme Kinetics
16. Effect of temperature on enzyme kinetics

**NOTE: ANY OTHER EXPERIMENT(S) MAY BE INCLUDED IN SUPPORT OF THE THEORETICAL ASPECTS OF THE COURSE.**

**Books Recommended** (Latest editions unless specified):
1. Pharmaceutical Chemistry (Source/ synthesis, Structure, stereochemistry, physicochemical properties, Structure activity relationships. Mode of action and Applications) of the following classes of drugs:
   a. Sulfonamides Sulfones and folate reductase inhibitors with antibacterial action:
      Sulfonamides and folate reductase inhibitors, Sulfonamides for burn therapy sulfonamides for intestinal infections.
   f. Antineoplastic Agents: Alkylating agents, Antimetabolites, Antitumor antibiotics Antitumour alkaloids. Hormones (Steroids, Tamoxifan, mitotane, Dormantanolone propionate Testalactone Magestrol acetate Miscellaneous compounds (Hydroxy urea, cisplatin, Pipobroman).

**Books Recommended (Latest editions unless specified):**

2. W.C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA
PHL170: PHARM. CHEM. XV: PHARMACEUTICAL ANALYSIS

3 Credits (2-1-0)

1. **Ultraviolet and Visible Spectroscopy**: Nature of electromagnetic radiation, the absorption of energy by atoms and molecules, the emission of radiant energy by atoms and molecules; Electronic excitation, Fundamental laws of photometry, deviation from Beers law, representation of spectral data, selection of wavelength and bond width chromophores, photometric error, instrumentation (radiation sources, monochromators and detectors), single and double beam instruments. Woodward Fieser rules and their applications, turbidimetry, naphlometry, polarimetry.

2. **Infrared Spectroscopy**: Theory characteristics absorbance bands of organic functional groups, interpretation of infrared absorption spectra frequency range, sample handling, infrared instrumentation (light sources, monochromators, detectors, FTIR), applications. Introduction to Raman spectroscopy and its difference with Infrared.

3. **Fluorimetric Analysis**: Theory quantitative description, factors affecting fluorescence intensity, relationship of fluorescence to molecular structure instrumentation, (Cells, light source, wavelength selection, detectors), correction of spectra and applications. Brief introduction to phosphorescence, flame emission and atomic absorption spectroscopy.

4. **Nuclear Magnetic Resonance Spectroscopy**: An Introduction to the theory of NMR, magnetic properties of the hydrogen nucleus, relaxation time chemical shift, spin-spin coupling, instrumentation, quantitative analysis of drugs, analytical limitations of NMR in Pharmaceutical analysis. Exchangeable protons. A brief introduction to fourier transform NMR and $^{13}$C NMR.

5. **Mass Spectroscopy**: Instrumentation (Ionization sources, electron impact ionization, Field ionization, chemical ionization and fast atom bombardment, sources). Analyzers single & double focusing, time of flight and quadrupole, mass spectra determination of molecular formulae, recognition of the molecular ion peak, fragmentation, mass spectra of some simple compounds.
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Books Recommended (Latest editions):
PHL166: Pharmacology (Clinical Pharmacology and Toxicology)  
Credits (2-1-0)

1. **Basics Concept:** Definition scope and development of clinical pharmacy and clinical pharmacology.

2. **Drug Discovery and Development:** Concept of pharmacogenology, preclinical evaluation, safety and clinical evaluation, post marketing surveillance and drug regulatory affairs.

3. **Basic and General Principles of Drug Therapy:**
   3.1 **Monitoring of Drug Therapy:** Therapeutic, pharmacokinetic and pharmacodynamic monitoring of drug therapy
   3.2 **Adverse Reactions to Drugs:** Incidence, classification and surveillance methods of adverse reactions to drugs.
   3.3 **Pharmacogenetics:** Pharmacokinetic and pharmacodynamic aspects of pharmacogenetics.
   3.4 **Drug Interactions:** Incidence, pharmacokinetics and pharmacodynamic drug interactions.
   3.5 **Patient Compliance:** Factors which affect compliance. Methods of measuring and improving drug compliance.
   3.6 **Pharmacology of Placebos:** Mode of action, uses and abuses, adverse effects and factors which influence the response of placebos. Drug therapy in special populations: Drug therapy in children, elderly (geriatric pharmacology) and pregnant and lactating mothers.

4. **Drug Information:** Sources of drug information and counseling of patients.

5. **Prescription Writing:** The principles of prescription writing and practical prescribing.

6. **Clinical Toxicology:** Principles and management of different types of poisoning and toxicity reactions.

**Recommended Books (Latest editions unless specified):**


PHL167: Pharmacognosy

Credits (2-1-0)

1. Recent developments in natural products with two examples each from anticancer, antimicrobial, antihepatotoxic, antiviral, antioxidants, antiprotozoals and CNS active plants.
2. Chemical standardization of plant drug material: Through marker analysis and fingerprint profiling.
3. Introduction to plant growth regulators and their physiological role.
4. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy.
5. Plant derived insecticide.
7. Natural allergens and photosensitizing agents and fungal toxins.
8. Herbs and health foods and neuropeptides and introduction to registration aspects of herbal products for marketing. Agencies controlling regulatory aspects for herbal products at national and international level. (WHO, EMEA etc).
9. Herbal cosmetics.

Books Recommended (Latest editions unless specified):
PHL168: Pharmaceutical Jurisprudence

3 Credits (2-1-0)

1. Definition and scope of Forensic Pharmacy, Pharmacist’s role in drug treatment, drug usage and pharmacist as a member of health care team.


3. Study of drugs and Cosmetics Act 1940 and Rules made there under; with special reference to application for import of drugs, licensing formalities for whole sale, retail sale, manufacturing test license for drugs and cosmetics, DPCO, Special emphasis on schedules C, C1, G, H, M, P, U, W, X and Y. Emphasis on labeling of various classes of drugs, recent amendments in Drugs and Cosmetics Act.


5. Medicinal and Toilet Preparations (excise duties) Act and rules made there under.


8. The Medical Termination of Pregnancy Act.


10. Forensic Toxicology

Books Recommended (Latest editions unless specified):

1. Drugs and Cosmetics Act, 1940 and All Amendments, Govt of India.

2. B. M. Mithal, Text Book of Forensic Pharmacy, National Book Centre,

3. Dr. Sundari Mohan Avenue, Calcutta, 700014.

4. Relevant Acts & Rules Published by the Government of India.

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PHL169: Pharmacokinetics & Biopharmaceutics

3 Credits (2-1-0)

1. Introduction to Pharmacokinetics and Biopharmaceutics, Various terms used, Absorption, distribution, metabolism and excretion of drugs. Biological half life, Apparent volume of distribution

2. Fluid compartments, Circulatory system and protein binding.

3. Compartment models
   3.1 One Compartment Open Model: Pharmacokinetics of single dose administration as applied to intravenous (rapid) and oral administration, Intravenous transfusion, Multiple intravenous and oral administration.
   3.2 Two Compartment Open Model: Pharmacokinetics of single and multiple dose administration, Intravenous transfusion.

4. Curve fitting- area under blood level curves

5. Urinary excretion studies, Sigma minus plot

6. Pharmacokinetic basis of sustained release formulations

7. Clinical Pharmacokinetics
   7.1 Hepatic elimination of drugs, Drug metabolism and its kinetics using one compartment and two compartment models. Liver extraction ratio and its relationship with absolute availability, Relationship between blood flow, Intrinsic clearance and hepatic clearance.
   7.2 Dosing of drugs in infants, elderly and obese patients.
   7.3 Dosage regimen adjustment in patients with and without renal failure. Dosage adjustments in uremic patients


Books Recommended (Latest editions unless specified):


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(Credit Based Continuous Evaluation Grading System)

PHP170: Pharmacology
1.5 Credits (0-0-1.5)

1 Prescription Evaluation: Exercises on clinical problems related to topic covered in theory.
2 Pharmacoepidemological studies using data collected from university Health Centre.
3 Calculation of LD50 Values and therapeutic index (statistical approach).
4 Experimental methods related to Biochemical Pharmacology using simulated samples and clinical samples collected from university Health Centre.
5 Bioassays Designs: Quantal and graded bioassays, matching and bracketing bioassays, 4 point bioassays.

Animal studies will be supplemented with simulated experiments with softwares wherever available.

Books Recommended (Latest editions unless specified):

3 Edinburgh University Pharmacology Staff (Ed.), Pharmacological Experiments on Isolated Preparations; Livingstone, London, U.K.
1. Establishment of a standard curve of a drug substance.
2. Influence of vehicle on drug availability from topical dosage forms in vitro.
3. Comparative in vitro release rate studies of marketed formulations.
4. Determination of bioavailability of marketed formulations by plasma concentration method.
5. Determination of bioavailability of marketed formulations by urinary excretion method.
6. Bioequivalence studies on marketed solid oral products.
7. Correlation between urinary and salivary excretion kinetics.
8. Determination of bioavailability by AUC, Counting square and Gravimetric methods.
9. Determination of acid neutralizing capacity of different brands of antacids.
10. Verification of Noyes Whitney Equation.
11. Protein binding studies using egg albumin as protein moiety.
BACHELOR OF PHARMACY (SEMESTER-VIII)
(Credit Based Continuous Evaluation Grading System)

PHP 172: Pharmacognosy

1.5 Credits (0-0-1.5)

Pharmacognosy Practical

1. Isolation of some selected phytoconstituents studied in theory.
2. Extraction of volatile oils and their chromatographic profiles.
3. Some experiments in plant tissue culture.

Books Recommended (Latest editions unless specified):