

w. e. f. AY 2016-17

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B. PHARMACY COURSE STRUCTURE (2016-17)**

**I YEAR II SEMESTER**

<b>S. No</b>	<b>Course Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	BS201	Pharmaceutical Inorganic Chemistry	3	1	0	3
2	BS202	Pharmaceutical Organic Chemistry – II	4	1	0	4
3	PS203	Physical Pharmacy - I	4	1	0	4
4	BS204	Statistical Methods and Computer Applications	3	1	0	3
5	PS205	Anatomy, Physiology and Health Education – II	4	1	0	4
6	BS206	Pharmaceutical Inorganic Chemistry Lab	0	0	3	2
7	BS207	Statistical Methods and Computer applications Lab	0	0	3	2
8	PS208	Physical Pharmacy – I Lab	0	0	3	2
9	*MC209	NCC/NSO	0	0	0	0
		<b>Total Credits</b>	<b>18</b>	<b>5</b>	<b>9</b>	<b>24</b>

**\*MC – Mandatory Course**

## BS201: PHARMACEUTICAL INORGANIC CHEMISTRY

**B. Pharm. I Year II Sem**

**L T P C**  
**3 1 0 3**

**Course Objectives:** The subject has been designed to make the students understand different categories of inorganic drugs/ compounds which are used as medicinal agents

**Course Outcome:** The knowledge gained by the student after studying the subject in detailed manner will be applicable to study and understand the concepts for higher classes.

### UNIT - I

1. Classification of Inorganic Pharmaceuticals based on their applications and therapeutic uses.
2. Sources of impurities in pharmaceutical substances.
3. Test for purity
  - a) Setting property of plaster of paris
  - b) Ammonium compounds in sodium bicarbonate
  - c) Oxalate in sodium citrate.
  - d) Barium and thiocyanate in Ammonium chloride
4. Qualitative tests for anion and cations
5. Limit tests for arsenic, heavy metals, lead, iron, chloride and sulphate.

*Note: Definition, Preparation, Assay principle, Limit tests and Uses of the compounds mentioned in Unit II to Unit V*

### UNIT - II

1. **Electrolytes:**
  - a) **Sodium and Potassium replenishers:** Sodium chloride, compound sodium chloride solution (Ringer solution), potassium chloride, ORS.
  - b) **Calcium replenishers:** Calcium gluconate, dibasic calcium phosphate, calcium chloride.
2. **Acid base regulators:** Sodium bicarbonate, sodium lactate, sodium citrate/potassium citrate, sodium acetate, and ammonium chloride
3. **Dialysis fluids:** Haemodialysis fluids.

### UNIT - III

#### **Gastro-intestinal agents.**

1. **Acidifiers and Antacids:** Dilute hydrochloric acid, sodium acid phosphate, sodium bicarbonate, aluminium hydroxide gel, dried aluminium hydroxide gel, magnesium oxide (Magnesia), magnesium hydroxide mixture, magnesium trisilicate.
2. **Adsorbents and related drugs:** Light kaolin, heavy kaolin, and activated charcoal.
3. **Laxatives:** Magnesium sulphate, sodium phosphate.
4. **Mineral Nutrients / Supplements**

a) **Haematinics** – Ferrous sulphate, ferrous fumarate, ferrous gluconate, ferric ammonium citrate, iron and dextrose injection.

b) **Halogens:** Iodine, Iodides.

**5. Pharmaceutical aids:**

a) **Excipients:** Dicalcium phosphate, magnesium stearate, talc and calcium carbonate (Precipitated chalk).

b) **Suspending agents:** Bentonite, colloidal silica.

c) **Colorants:** Titanium oxide, Ferric oxide

**UNIT - IV**

a) **Expectorants:** Ammonium chloride, potassium iodide.

b) **Emetics:** Potassium antimony tartarate, copper sulphate.

c) **Antidotes:** Sodium thiosulphate, sodium nitrite.

**Topical agents:**

1. **Astringents:** Zinc sulphate, calcium hydroxide, Bismuth sub carbonate.

2. **Topical protectants:** Zinc oxide, calamine, zinc stearate, talc, titanium-dioxide, heavy kaolin and light kaolin (only uses).

3. **Silicone polymers:** Activated dimethicone.

4. **Anti-Infectives:** Hydrogen peroxide solution, potassium permanganate, silver nitrate (silver protein), iodine, (solutions of iodine, povidone iodine), boric acid, zinc undecylenate, mercury compounds (yellow mercuric chloride)

**UNIT - V**

**Dental products:**

1. **Fluorides:** Sodium fluoride, sodium monofluorophosphate and stannous fluoride.

2. **Oral antiseptics and Astringents:** Hydrogen peroxide, magnesium, peroxide, zinc peroxide and mouth washes.

3. **Dentifrices:** Calcium carbonate, dibasic calcium phosphate, calcium phosphate, sodium metaphosphate and strontium chloride.

4. **Cements & fillers :** Zinc oxide (only uses).

**Miscellaneous Medicinal Agents**

- |                          |   |                           |
|--------------------------|---|---------------------------|
| a) Antineoplastics       | : | Cisplatin                 |
| b) Antidepressants       | : | Lithium carbonate         |
| c) Diagnostic agents     | : | Barium sulphate           |
| d) Surgical Aids         | : | Plaster of Paris          |
| e) Antirheumatic agents  | : | Sodium aurothiomalate     |
| f) Internal parasiticide | : | Sodium antimony gluconate |
| g) Anti thyroid agents   | : | Potassium perchlorate     |

### **TEXT BOOKS**

1. A. H. Beckett and J. B. Stenlake, Practical pharmaceutical chemistry, Part-I. The Athtone press,
2. University of London, London.
3. P. Gundu Rao, Inorganic pharmaceutical chemistry; Vallabh Prakashan, Delhi.
4. Advanced Inorganic Chemistry by Satya Prakash, G. D. Tuli

### **REFERENCES**

1. L.M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Oxford University Press, London.
2. Indian Pharmacopoeia 1996, 2006.

## BS202: PHARMACEUTICAL ORGANIC CHEMISTRY - II

**B. Pharm. I Year II Sem**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Course Objectives:** The organic compounds are classified based on their functional groups and character. The basic principles and mechanisms of different types of organic reactions are explained in an elaborative manner.

**Course Outcome:** The detailed study on the mechanisms involved in various reactions would help the students to understand the synthesis of higher organic compounds which would be dealt in future classes.

### UNIT - I

**Carbonyl Compounds:** Nomenclature, two important methods of preparation, polarity of carbonyl group, relative reactivities of carbonyl compounds, nucleophilic addition and addition-elimination reactions, oxidation-reduction reactions, aldol condensation, Cannizzaro reaction, benzoin condensation, Perkins reactions, Reformatsky reaction, Oppenauer oxidation.

### UNIT - II

**a. Ethers:** Nomenclature, Williamson's synthesis, action of hydroiodic acid on ethers (Ziesel's method).

**b. Phenols:** Nomenclature, general methods of preparation, physical properties, acidity of phenols, stability of phenoxide ion, reactions of phenols, Kolbe-schmidt reaction stability of conjugated dienes, and Fries rearrangement, Reamer-Tiemann Reaction.

### UNIT - III

**a. Carboxylic acids and their derivatives:**

**Carboxylic acids:** Nomenclature, intermolecular association, stability of carboxylate anion, two important methods of preparation, decarboxylation, functional groups reactions, reduction of carboxylic acids. a note on dicarboxylic acids.

**b. Acid derivatives:** (acid chlorides, anhydrides, esters and amides). Nomenclature, reactions like hydrolysis, reduction of esters and amides, Hofmann's degradation of amides. Brief account of preparation and properties of malonic and acetoacetic esters, their importance in organic syntheses.

### UNIT - IV

**a. Nitro compounds:** Nomenclature, acidity of nitro compounds containing  $\alpha$ - hydrogens, reductive reactions of aromatic nitro compounds.

**b. Nitriles and isonitriles:** Nomenclature, two methods of synthesis, reactivity and functional reactions.

## **UNIT - V**

**a. Amines:** Nomenclature, basicity of amines, classification, relative reactivity, Hinsberg method of separation, acylation reactions. Diazotisation and reactions of diazonium salts.

**b. Organo metallic compounds:** Synthetic applications of Grignard reagent

### **TEXT BOOKS:**

1. T. R. Morrison and R. N. Boyd, Organic chemistry, Prentice Hall of India Private Limited, New Delhi.
2. I.L. Finar Vol.I. & Vol. II., the Fundamentals Principles of Organic Chemistry, ELBS/Longman.
3. Ball & Ball, Advanced pharmaceutical organic chemistry.

### **REFERENCES:**

1. Jerry March, Advanced Organic Chemistry
2. Bruce, Organic chemistry

## PS203: PHYSICAL PHARMACY – I

**B. Pharm. I Year II Sem**

**L T P C**  
**4 1 0 4**

**Course Objectives:** The student shall know important physical properties of drug molecules, phase value & its importance. Different law of thermodynamics, electrolyte and non-electrolyte solutions, importance of  $p^H$  and drug research.

**Course Outcome:** Student will know about physical properties of molecules, three laws of thermodynamics, properties of electrolytes and non electrolytes,  $p^H$  and buffers. They also understand the importance of these studies in the physical pharmaceutics & Formulation development.

### UNIT - I

**Physical properties of Drug Molecules:** Dielectric constant induced polarization, dipole moment, refractive index and molar refraction and optical rotatory dispersion.

### UNIT - II

**a. Phase equilibria and the phase rule:-** System containing single component, System containing two component, two component system containing solid and liquid phases, three component systems

**b. Thermodynamics:** The first law of thermodynamics. The second law of thermodynamics. The third law of thermodynamics, Free energy functions and applications.

### UNIT - III

**a. Solutions of Electrolytes:** Properties of solutions of electrolytes. The Arrhenius theory of electrolyte dissociation. The modern theory of strong electrolytes and other coefficients for expressing colligative properties.

**b. Solutions of Non electrolytes:** Concentration expressions, ideal and real solutions, colligative properties, molecular weight determinations.

### UNIT - IV

**Ionic equilibria:** Modern theories of acids, bases and salts, Sorensen's  $pH$  scale, species concentration as a function of  $pH$ , calculation of  $pH$  and acidity constants.

### UNIT - V

**Buffers and buffered isotonic systems:** The buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions, methods of adjusting tonicity and  $pH$  (relevant numerical problems).

**TEXT BOOKS:**

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences Fifth Edition.
2. C. V. S. Subramanyam, Essentials of Physical Pharmacy, Vallabh Prakashan.
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.

**REFERENCES:**

1. Pharmacopoeias, (I.P., B.P., U.S.P. and European.)
2. Martindale, The Extra Pharmacopoeia; latest edition, the Royal Pharmaceutical Society.



## BS204: STATISTICAL METHODS AND COMPUTER APPLICATIONS

**B. Pharm. I Year II Sem**

**L T P C**  
**3 1 0 3**

**Course Objectives:** The objective of the course, centered around various techniques, collection of data and its treatment; Probability and distribution, correlation, regression and statistical inferences, besides computer application.

**Course Outcome:** At the end of the course the expected outcomes are thorough knowledge of statistical techniques and application of computer in pharmacy

### **Section - A: Bio-statistics**

#### **UNIT - I**

**Data collection and treatment:** Data Collection and organization, diagrammatic representation of data( bar, pie, 2-D and 3-D diagrams), standard deviation and standard error of means, co-efficient of variation, Correlation and regression analysis.

**Probability and Distributions:** Bayer's theorem, probability theorem, elements of binomial and Poisson distribution, normal distribution curve and properties.

#### **UNIT - II**

**Statistical inference:** Common parametric and non-parametric tests (t-test, F-test,  $X^2$ -test employed in testing of significance in biological/pharmaceutical experiments and elements of ANOVA (One way and two way).

#### **UNIT - III**

**Design of experiments:** Basic concepts of CRD, RBD and Latin square designs.

**Sampling and Quality Control:** Concept of random sampling, statistical QC charts. Applications of statistical concepts in pharmaceutical sciences.

### **Section - B: Computer Applications**

#### **UNIT - IV**

**MS-Excel:** Basics, spreadsheets, data types, formulas, formatting, charts, graphs. Calculation of statistical parameters using excel.

**MS-Power Point:** Power point Basics, views, slide controls, applied design, page setup, templates, back ground control, colour screens, transitions, and animations, working with texts, and working with graphics.

#### **UNIT - V**

**Database Management:** Concepts and Objectives of database management systems, advantages of the database management systems and examples of DBMS packages (like DBASE III)

Introduction to structured Query language (SQL): over view of SQL, Reserved words, SQL Commands. **Computer Applications** in pharmaceutical and clinical studies.

**TEXT BOOKS:**

1. Sanford Boltan, Pharmaceutical statistics, Practical and clinical applications
2. Pranab Kumar Benarjee, Introduction to Biostatistics
3. Khan and Khanum, Fundamentals of Biostatistics

**REFERENCES:**

1. Roger E. Kirk, Statistics an introduction, Thomson Wadsworth
2. Walter T. Ambrosius, Topics in Biostatistics, Humana Press

## PS205: ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION - II

**B. Pharm. I Year II Sem**

**L T P C**  
**4 1 0 4**

**Course Objectives:** This course is designed to impart a fundamental knowledge on the structure and functions of the human body. Since a medicament, which is produced by pharmacist, is used to correct the deviations in human body, it enhances the understanding of how the drugs act on the various body systems in correcting the disease state of the organs.

**Course Outcomes:** Knowledge on structure and functions of various organs of the human body and the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body and the pathological states

### UNIT - I

**Central Nervous System:** Functions of different parts of brain and spinal cord, reflex action, electroencephalogram, cranial nerves and their functions. Epilepsy, psychosis, depression, mania, Parkinsonism, Alzheimer's disease.

**Autonomic Nervous System:** Physiology and functions of autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.

### UNIT - II

**Respiratory System:** Anatomy of respiratory organs. Functions of respiration, mechanism and regulation of respiration, respiratory volumes and vital capacity. Asthma, tuberculosis.

**Urinary System:** Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance, acute and chronic renal failure.

### UNIT - III

**Endocrine System:** Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenals, pancreas their hormones and functions. Diabetes, Hyperthyroidism, and Hypothyroidism.

### UNIT - IV

**Reproductive Systems:** Male and Female reproductive systems and their hormones, physiology of menstruation, Sex differentiation, Pregnancy its maintenance and parturition.

### UNIT - V

**Basic Principles of Cell Injury, Adaptation & process of inflammation:** Causes of cellular injury, pathogenesis, morphology of cell injury. Cellular adaptations, atrophy, hypertrophy. Acute and chronic inflammation, mediators of inflammation.

### TEXT BOOKS:

1. Tortora, G.J and Anagnodokas, Principles of Anatomy and Physiology, N.P Harper & Row Publishers N.Y

2. Ross & Wilson, Text Book of Human Anatomy, M. J. Mycek, S.B Gerther and MMPER
3. Robbins, SL & Kumar, Basic Pathology.

**REFERENCES:**

1. Guyton, Textbook of Medical Physiology, AC Guyton WB Sannders Company, 1995.
2. K. Sembulingam and Prema Sembulingam, Essentials of Medical Physiology, 3rd Edition, Jaypee Bros, New Delhi.

## BS206: PHARMACEUTICAL INORGANIC CHEMISTRY LAB

**B. Pharm. I Year II Sem**

L	T	P	C
0	0	3	2

**List of experiments:**

**A) Limit tests for the following as per the procedure given in Indian Pharmacopoeia (1996 – Including the latest addenda)**

1. Chlorides
2. Sulphates
3. Heavy metals
4. Iron
5. Arsenic (demonstration)

**B) Balances and Weighing; Calibration of weights, Pipette and Burette.**

1. Preparation and standardization of Hydrochloric acid solution (0.1N).
2. Preparation and standardization of Potassium permanganate solution (0.1N & 0.1M).
3. Preparation of a primary standard solution of 0.1N Potassium hydrogen-phthalate.
4. Preparation and standardization of 0.1N EDTA solution.
5. Preparation and purification of Boric acid.
6. Preparation and purification of Sodium citrate.
7. Preparation and purification of Potash alum.
8. Preparation and purification of Magnesium stearate.
9. Assay of sodium bicarbonate and assay of Boric acid (Neutralization).
10. Assay of Calcium gluconate (or) any calcium compounds (Complexometry).
11. Assay of Copper sulphate (Redox titration).
12. Assay of Sodium acetate (Non-aqueous titration).
13. Assay of Ferrous sulphate (Oxidation-reduction / Redox titration).
14. Exercises related to assay by Gravimetric method.

**NOTE:** Minimum 15 experiments must be performed.

**REFERENCES:**

1. Indian Pharmacopoeia - 2010.
2. Vogel's Qualitative Analysis

## **BS207: STATISTICAL METHODS AND COMPUTER APPLICATIONS LAB**

**B. Pharm. I Year II Sem**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

1. **Solving biostatistics problems** related to inference, sampling, graphical representation of data etc., with the help of calculators & software programs like Graph-pad.
2. **Sample programs in C:** Program to calculate simple and complex arithmetic expressions, program using structures, program using loops and nested loops, program using functions and simple programs using arrays.
3. **Operating systems** like WINDOWS, UNIX, etc.
4. **Software packages** like MS-WORD, EXCEL, ACCESS, and POWER POINT.

## PS208: PHYSICAL PHARMACY – I LAB

**B. Pharm. I Year II Sem**

**L T P C**  
**0 0 3 2**

### **List of experiments:**

1. Percent composition determination by Capillary Flow method
2. Percent composition determination by polarimeter & refractometer
3. Molecular weight determination by Landsberger method.
4. Molecular weight determination by Rast camphor method.
5. Calibration of pH Meter
6. pH Estimation – pH meter
7. pH Estimation – colourimetric method.
8. pH Estimation by Half Neutralization Method
9. Refractive index of liquids.
10. Molar refraction determination
11. Effect of dielectric constant on the solubility of the drug.
12. Phenol water system – CST
13. Lower consolute temperature – Terephthalamine and Water
14. Heat of neutralization
15. Phase diagram - Phenol – Water, Effect of Impurities.
16. Ternary phase diagram.
17. Preparation of Buffers and Buffer Capacity Determination.

**NOTE:** Minimum 15 experiments must be performed.

### **REFERENCES:**

1. Physical pharmacy practical book by C.V.S. Subramanyam
2. Physical pharmacy practical text by Guru Prasa Mohanta, Prabal Kumar Manne