Gyanmanjari Innovative University

Course Syllabus

Gyanmanjari Pharmacy College

Semester-I (B. Pharm)

Subject: Pharmaceutical Inorganic and Analytical Chemistry (BPHBP11356)

Type of course: Major

Prerequisite: B. Pharmacy

Rationale:

1. Pharmaceutical Inorganic and Analytical Chemistry provide the fundamental knowledge of inorganic pharmaceutical substances and analytical techniques that are essential for ensuring the quality, safety, and efficacy of medicines.
2. The course develops an understanding of pharmaceutical analysis, sources of errors, impurities, buffer systems, and various titrimetric methods used in drug analysis.
3. It also introduces inorganic compounds of pharmaceutical importance, including gastrointestinal agents, radiopharmaceuticals, expectorants, haematinics, and antidotes, along with their therapeutic applications.
4. This course equips students with the analytical skills required for quality control, regulatory compliance, and pharmaceutical practice, thereby forming a strong foundation for advanced pharmaceutical sciences and professional pharmacy practice.

Teaching and Examination Scheme:

Course Code	Course Title			Course Type
BPHBP11356	**Pharmaceutical Inorganic and Analytical Chemistry (Theory)**			**Core**
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
3	3	--	--	45
Maximum Marks	MSE			ESE
75	30			45

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the importance of errors, impurities in pharmaceuticals.
2. Comprehend the principles of buffer systems.
3. Develop skills in performing and interpreting limit tests and titrimetric analysis.
4. Emphasize the importance of inorganic compounds and radiopharmaceuticals in Pharmacy
5. Explain synthesis and analysis of inorganic compounds/products of pharmaceutical importance

Course Content:

Unit No.	Topics	Hrs.	% Weightage
1.	**Introduction to pharmaceutical analysis** Different techniques of analysis, Methods of expressing strength of solutions, Primary and secondary standards with examples. **Errors** Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures. **Impurities** Definition, types, contents and regulatory importance. Sources and types of impurities in Pharmaceuticals, limit tests for chloride, sulphate, iron, arsenic, lead, heavy metals, and modified limit test for chloride and sulphate.	07	25
2.	**Acid-Base Chemistry and Buffer Systems in Pharmacy** Definition of acids, bases, buffers, pH Scale and its significance, Buffer equation, calculation of pH for Buffer solution. Isotonicity and its application in IV Fluids and Ophthalmic Solutions.	10	25

	Major extra and intracellular electrolytes Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium chloride and Oral Rehydration Salt (ORS), Physiological acid base balance.		
3.	**Acid base titrations** Theories of acid base indicators, classification of acid base titrations. Preparation and standardization of titrants viz. hydrochloric acid and sodium hydroxide. Theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves. Assay of Ammonium hydroxide. **Non-aqueous titrations** Types of solvents used, acidimetric and alkalimetric titration using non aqueous solvents. Preparation and standardization of acidic and basic titrants. Estimation of weakly acidic and basic substances using non aqueous titrants, estimation of Sodium benzoate. **Precipitation titrations and gravimetry** Principle and steps involved in gravimetric analysis, Mohr's method, Volhard's, Modified Volhard's, Fajans method. Estimation of barium sulphate by gravimetry. **Complexometric titrations** Classification, metal ion indicators, masking and demasking reagents, preparation and standardization of disodium EDTA. Estimation of Magnesium sulphate and Calcium gluconate*. **Redox titrations** Concepts of oxidation and reduction, Types of redox titrations viz. Permanganometry, Cerimetry, Iodimetry, Iodometry and titrations with potassium iodate.	12	20
4.	**Gastrointestinal agents** Acidifiers: Sodium acid phosphate and Dilute Hydrochloric acid. Antacids: Ideal properties of antacids, combinations of antacids, Sodium bicarbonate*, Aluminium hydroxide gel*. Agents promote bowel movements Magnesium hydroxide, Sodium	10	15

	orthophosphate, Sodium Potassium tartrate and magnesium trisilicate. Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations. **Radiopharmaceuticals** Basics of radioactivity, applications of radioisotopes of Sodium Iodide I-131, Technetium-99m, Cobalt-60, Phosphorus-32 including safe handling, storage, and disposal of radiopharmaceuticals, adhering to regulatory guidelines for safety.		
5.	**Miscellaneous Compounds** **Expectorants:** Potassium iodide, Ammonium chloride*. **Emetics:** Copper sulphate*, Sodium potassium tartrate. **Haematinics:** Ferrous sulphate*, Ferrous gluconate. **Poison and Antidote:** Definition, classification of antidotes, Sodium thiosulphate	06	15

Recommended References (Preferably Latest Editions)

1. Bentley, R. and Driver, J. Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Latest Edition.
2. Vogel, A. I. Vogel's Textbook of Quantitative Chemical Analysis. Pearson Education Limited, Latest Edition.
3. Beckett, A. H. and Stenlake, J. B. Practical Pharmaceutical Chemistry, Part I & II. The Athlone Press, University of London, Latest Edition.
4. Schroff, M. L. Inorganic Pharmaceutical Chemistry. Oxford Book Company, Latest Edition.
5. Indian Pharmacopoeia Commission. Indian Pharmacopoeia (IP). Latest Edition, Ghaziabad, India.

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	**Pharmaceutical Calculations:** Faculty will provide numerical problems related to buffer systems, pH, isotonicity, and pharmaceutical calculations. Students will solve and upload the solutions on Moodle.	05
2.	**Assignment:** Faculty will assign topics on pharmaceutical analysis, impurities, limit tests, and analytical techniques. Students will prepare the assignment and submit it on Moodle.	05
3.	**Diagram and Applications:** Faculty will provide the name of analytical apparatus, pharmaceutical compounds, or titration methods. Students will draw the diagram, explain the principle, and write pharmaceutical applications before uploading on Moodle.	05
Total		15

Suggested Specification table with Marks

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage	35%	40%	10%	10%	10%	

Subject: Pharmaceutical Inorganic and Analytical Chemistry-Practical (BPHBP11356)

Course Code	Course Title			Course Type
BPHBP11356	**Pharmaceutical Inorganic and Analytical Chemistry (Practical)**			**Core**
Credit	Hours Per Week (L-T-P)			Max. Hours
	L	T	P	
1	--	--	3	45
Maximum Marks	SE			ESE
50	20			30

Course Outcome:

After learning the course, the students should be able to:	
CO1	Explain the concepts of pharmaceutical analysis, sources of errors, impurities, and methods for expressing the strength of pharmaceutical solutions
CO2	Apply the principles of acid–base chemistry, buffer systems, pH calculations, isotonicity, and physiological electrolytes in pharmaceutical formulations.
CO3	Perform and interpret pharmaceutical analytical techniques including acid–base, non-aqueous, precipitation, complexometric, gravimetric, and redox titrations.
CO4	Analyze the properties, mechanisms, and pharmaceutical applications of gastrointestinal agents, antimicrobials, and radiopharmaceuticals.
CO5	Describe the therapeutic uses and pharmaceutical importance of expectorants, emetics, haematinics, antidotes, and other inorganic compounds used in pharmacy.

List of Practical:

Sr. No.	Description	Hrs.	Unit
1.	Perform limit test and modified limit test for Chloride as per Indian Pharmacopoeia.	3	I
2.	Perform limit test and modified limit test for Sulphate as per Indian Pharmacopoeia.	3	I
3.	Perform Limit Test for Iron as per Indian Pharmacopoeia.	3	I
4.	Perform Limit Test for Lead/Arsenic as per Indian Pharmacopoeia.	3	I
5.	Prepare Aluminium Hydroxide and evaluate the product.	3	2
6.	Prepare Potash Alum and evaluate the product.	3	2
7.	Prepare Ferrous Sulphate or Magnesium Sulphate and evaluate the product.	3	2
8.	Determine the Swelling Power of Bentonite as per Indian Pharmacopoeia.	3	3
9.	Evaluate the Acid Neutralizing Capacity of Aluminium Hydroxide Gel.	3	3
10.	Determine Potassium Iodate and Iodine in Potassium Iodide.	3	3
11.	Perform Assay of Ammonium Chloride by acid–base titration.	3	4
12.	Perform Assay of Ferrous Sulphate by Cerimetry.	3	4
13.	Perform Assay of Copper Sulphate by Iodometry.	3	4
14.	Perform Assay of Calcium Gluconate / Hydrogen Peroxide by appropriate titrimetric method.	3	4
15.	Perform Assay of Sodium Benzoate / Sodium Chloride using the prescribed titration method.	3	4
	Total	45	

Course Outcome:

Upon successful completion of this course, the students will be able to:	
1	Perform limit tests to detect and identify impurities in pharmaceutical substances.
2	Prepare pharmaceutical inorganic compounds following standard laboratory procedures.
3	Evaluate the quality and purity of pharmaceutical substances using pharmacopoeial methods.
4	Perform assay of pharmaceutical inorganic compounds using appropriate volumetric titration techniques.
5	Apply qualitative and quantitative analytical techniques for pharmaceutical analysis and interpretation of results.

Instructional Method:

- Demonstration of pharmaceutical practicals by the faculty.
- Hands-on laboratory experiments following Indian Pharmacopoeia (IP) procedures.
- Preparation and standardization of pharmaceutical reagents and inorganic compounds.
- Performance of limit tests, purity tests, and assay of pharmaceutical substances.
- Observation, result interpretation, and maintenance of practical records.
- Discussion, viva-voce, and continuous assessment based on laboratory performance.

Reference Books:

1. Bentley, R. and Driver, J. Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press.
2. Vogel, A. I. Vogel's Textbook of Quantitative Chemical Analysis. Pearson Education Limited.
3. Beckett, A. H. and Stenlake, J. B. Practical Pharmaceutical Chemistry, Part I & II The Athlone Press, University of London.
4. Kennedy, J. H. Analytical Chemistry: Principles. Saunders College Publishing.
5. Schroff, M. L. Inorganic Pharmaceutical Chemistry. Oxford Book Company.
6. Indian Pharmacopoeia Commission. Indian Pharmacopoeia (Latest Edition). Ghaziabad, India.