COURSE HANDOUT

PHARMACEUTICAL INORGANIC CHEMISTRY- I (THEORY)

COURSE CODE: BP104T

VISION

Train the minds to think logically and become a success

MISSION

To Develop inventive, pioneering research & high-quality technical education

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: To produce graduates with sound theoretical knowledge and technical skills required for career opportunities in various domains.

PEO 2: To incite the students towards research and to address the challenges with their innovative Contributions for the benefit of mankind.

PEO 3: To bring forth a quality professional equipped with technological advances to adapt easily to changes in the ever-evolving pharma and allied industry, hospital and clinical pharmacy setup, pharma retailing and distribution, and governmental and health agencies.

PEO 4: To engage graduates in professional ethical practices in a multidisciplinary environment, while contributing to organization through leadership and building team spirit.

PEO 5: Pharmacists can become lifelong learners, absorb new technologies, and then offer leadership roles in society.

Programme Name	Bachelor of Pharmacy (B. Pharmacy)
Course Name	Pharmaceutical Inorganic Chemistry- I (Theory)
Course Code	BP104T
Session	
Semester	I
Lecture/Tutorial (Per Week)	3 (3-1-0)
Course Credit	4
Course Coordinator Name	

1. Scope of the Course:

This subject deals with the monographs of inorganic drugs and pharmaceuticals. The subject emphasizes the sources of impurities and methods to determine the impurities in pharmaceuticals. The subject also emphasizes on the medicinal and pharmaceutical importance of inorganic compounds.

2. Course Outcomes (COs):

104.1 Acquaint with the sources and methods to determine the impurities in pharmaceuticals and inorganic drugs with the help of limit tests.

104.2 Explicate the importance of acids, bases, buffers, dentifrices and major physiological ions in pharmaceutical systems.

104.3 Understand the methods of preparation, properties, assay, medicinal and pharmaceutical importance of gastro intestinal Agents.

104.4 Express the preparations, properties, and tests for identity, purity, assay, actions and uses of the different classes such as expectorants, emetics, haematinics, poisons, antidotes and astringents.

104.5 Study of radioactivity, storage conditions, precautions, measurement and pharmaceutical applications of radio isotopes in pharmacy.

3. Text Books:

TB.1 Chatwal GR. Pharmaceutical Chemistry – Inorganic, Vol. I. Himalaya Publishing House, New Delhi.

TB.2 Gundu Rao P. Inorganic Pharmaceutical Chemistry. Vallabh Prakashan, New Delhi.

TB.3 Bothara KG. Inorganic Pharmaceutical Chemistry. Nirali Prakashan, New Delhi.

TB.4 Ali M. Textbook of Pharmaceutical Chemistry-I (Inorganic). CBS Publishers and Distributors, New Delhi.

4. Reference Books:

RB.1 Roche EB, Block JH, Soine TO, Charles O. Wilson Block Inorganic Medicinal and Pharmaceutical Chemistry. Varghese Publishing House.

RB.2 Bentley AO, Driver JE, Atherden LM. Bentley and Driver's Textbook of Pharmaceutical Chemistry, Oxford University Press.

RB.3 Svehla G. Vogel's Qualitative Inorganic Analysis. Pearson, India.

RB.4 Indian Pharmacopoeia. Ministry of Health & Family Welfare, Govt. of India.

RB.5 British Pharmacopoeia. British Pharmacopoeia Commission, London.

5. Other Readings & Relevant Websites:

Sr. No.	Link of Journals, Magazines, Websites and Research Papers
1	https://www.pharmatutor.org/
2	https://www.expresspharma.in/pharma-pulse/inorganic-pharmaceuticals/
3	https://onlinelibrary.wiley.com/doi/book/10.1002/9781118695425/
4	https://www.scribd.com/book/431648754/Pharmaceutical-Inorganic-Chemistry/
5	https://www.expresspharma.in/pharma-pulse/inorganic-pharmaceuticals/
6	https://global.oup.com/uk/orc/pharmacy/ifp_chemistry/01student/answers/
7	http://www.naturalspublishing.com/show.asp?JorID=50&pgid=0/

6. Course Plan:

Subject: Pharmaceutical Inorganic Chemistry- I (Theory)		**Subject Code:** BP104T
Study of sources of impurities, methods to determine the impurities in inorganic drugs, acid-base concept, major physiological ions and monographs of inorganic drugs and pharmaceuticals.		
Sr. No.	**Topics**	**No. of Lectures**
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.	10
2	**Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity. **Major extra and intracellular electrolytes:** Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance. **Dental products:** Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.	10
3	**Gastrointestinal agents: Acidifiers:** Ammonium chloride and Dil. HCl. **Antacids:** Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate, Aluminum hydroxide gel, Magnesium hydroxide mixture.	05
ST-I (Syllabus Covered from Lecture 01 to 25)		
1	**Gastrointestinal agents: Cathartics:** Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite. **Antimicrobials:** Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations.	05
2	**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 nitrite. **Astringents:** Zinc Sulphate, Potash Alum.	08
3	**Radiopharmaceuticals:** Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half-life, radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions, precautions & pharmaceutical application of radioactive substances.	07
ST- II (Syllabus Covered from Lecture 26 to 45)		

7. Lecture Plan:

Lect No.	Topics	Dates (tentative)		CO
		Section A	Section B	
01	Introduction of impurities in pharmaceutical substances	11.09.23	11.09.23	104.1
02	History of pharmacopoeia	13.09.23	12.09.23	104.1
03	Sources and types of impurities	15.09.23	14.09.23	104.1
04	Limit tests for Chloride	18.09.23	18.09.23	104.1
05	Limit tests for Sulphate	20.09.23	19.09.23	104.1
06	Limit tests for Lead and Arsenic	22.09.23	21.09.23	104.1
07	Test	25.09.23	25.09.23	104.1
08	Limit tests for Heavy metals	27.09.23	26.09.23	104.1
09	Modified Limit tests for Chloride	29.09.23	28.09.23	104.1
10	Modified Limit tests for Sulphates	02.10.23	03.10.23	104.1
11	Buffer equations and buffer capacity	04.10.23	05.10.23	104.2
12	Buffers in pharmaceutical systems and preparation	06.10.23	09.10.23	104.2
13	Stability and buffered isotonic solutions	09.10.23	10.10.23	104.2
14	Measurements of tonicity, calculations and methods of adjusting isotonicity.	11.10.23	12.10.23	104.2
15	Functions of major physiological ions	13.10.23	16.10.23	104.2
16	Electrolytes used in the replacement therapy: Sodium chloride, Potassium chloride	16.10.23	17.10.23	104.2
17	Test	18.10.23	19.10.23	104.2
18	Calcium gluconate and Oral Rehydration Salt (ORS) and Physiological acid base balance	20.10.23	23.10.23	104.2
19	Dentifrices, role of fluoride in the treatment of dental caries	23.10.23	24.10.23	104.2
20	Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement	25.10.23	26.10.23	104.2
21	Acidifiers: Ammonium chloride and Dil. HCl	27.10.23	30.10.23	104.3
22	Antacid: Ideal properties of antacids	30.10.23	02.11.23	104.3
23	Combinations of antacids and Sodium Bicarbonate	03.11.23	06.11.23	104.3
24	Test	06.11.23	07.11.23	104.3
25	Magnesium hydroxide gel and Aluminum hydroxide gel	08.11.23	09.11.23	104.3
26	Cathartics: Magnesium sulphate, Sodium orthophosphate	10.11.23	13.11.23	104.3
27	Kaolin and Bentonite	13.11.23	14.11.23	104.3
28	Antimicrobials: Mechanism and classification	15.11.23	16.11.23	104.3
29	Potassium permanganate, Boric acid	17.11.23	20.11.23	104.3
30	Hydrogen peroxide, Chlorinated lime, Iodine and preparations	04.12.23	21.11.23	104.3
31	Expectorants: Potassium iodide, Ammonium chloride	04.12.23	23.11.23	104.3
32	Emetics: Copper sulphate, Sodium potassium tartarate	06.12.23	27.11.23	104.4
33	Test	08.12.23	28.11.23	104.4
34	Haematinics: Ferrous sulphate and Ferrous gluconate	11.12.23	30.11.23	104.4
35	Poison and Antidote: Sodium thiosulphate	13.12.23	23.11.23	104.4
36	Activated charcoal	15.12.23	04.12.23	104.4
37	Sodium Nitrite	18.12.23	05.12.23	104.4
38	Astringent: Zinc Sulphate and Potash alum	20.12.23	07.12.23	104.4
39	Radiopharmaceuticals: Radioactivity and measurement of radioactivity	22.12.23	11.12.23	104.4
40	Properties of α, β, γ radiations	04.01.24	12.12.23	104.5
41	Radio isotopes and study of radio isotopes - Sodium iodide	04.01.24	14.12.23	104.5
42	Pharmaceutical application of radioactive substances	08.01.24	18.12.23	104.5
43	Half Life of radiopharmaceuticals and Storage conditions	10.01.24	19.12.23	104.5
44	Precautions of radiopharmaceuticals	12.01.24	25.12.23	104.5
45	Test	15.01.24	26.12.23	104.5

8. Tutorial Plan

Tutorial No.	Topic	Tentative date

1	Introduction of impurities in pharmaceutical substances	05.09.23
2	Limit Tests	12.09.23
3	Acids, Bases and Buffers	19.09.23
4	Major Physiological Ions	26.09.23
5	Dentifrices	30.09.23
6	Gastrointestinal agents- Acidifiers and Antacid	03.10.23
7	Cathartics and Antimicrobials	10.10.23
8	Mechanism of Antimicrobials	17.10.23
9	Classification of Gastrointestinal agents	31.10.23
10	Emetics and Expectorants	07.11.23
11	Haematinics	14.11.23
12	Astringents	21.11.23
13	Radiopharmaceuticals	28.11.23
14	Applications	05.12.23
15	Radioactivity and Half-Life	12.11.23

9. Assignments Plan:

Sr. No.	Type of Assignment	Assignment	Marks	CO	PO (Annexure I)	Tentative Date
1	Group Assignment	Give examples of inorganic compounds used in everyday life.	10	104.1	PO1, PO6, PO11	29.09.23
2	Group Assignment	Identify and list common acids and bases found in household items or foods and determine the pH by the use of pH Paper.	10	104.2	PO1, PO9, PO11	16.10.23
3	MCQs	A set of 50 multiple-choice questions(MCQs) pertaining to gastrointestinal medications and treatments.	10	104.3	PO1, PO2, PO4, PO6, PO9, PO11	13.12.23
4	Open Book Assignment	"Poisons and Antidotes" and list some common chemicals that can cause poisoning and their corresponding antidotes.		104.4	PO1, PO3, PO9, PO11	10.01.24
5	MCQs	Write the regulatory guidelines and safety protocols governing the use of radiopharmaceuticals.	10	104.5	PO1, PO2, PO3, PO11	29. 01.24

10. Class Tests Schedule:

Sr. No.	Test Type	Topics	Marks	CO	PO (Annexure I)	Tentative Date
1	Subjective	Limit tests and impurities present in pharmaceuticals	20	104.1	PO1, PO2, PO3, PO9	25.09.23
2	Subjective	Buffers and Acid-Base concept	20	104.2	PO1, PO6, PO9, PO11	18.10.23
3	Subjective	Discuss the mechanisms and classification of antimicrobial agents and write a note on hydrogen peroxide, chlorinated lime	20	104.3	PO1, PO6, PO9, PO11	06.11.23
4	MCQS	Emetics, expectorants and haematinics	20	104.4	PO1, PO3, PO9	08.12.24
5	Subjective	Measurement and applications of radiopharmaceuticals	20	104.5	PO1, PO6, PO9, PO11	15.01.24

11. Content Beyond Syllabus (CBS):

Sr. No.	Topics	PO to be Achieved (Annexure I)
1	Nanostructured Inorganic Materials for Sustainable Energy Applications	PO1, PO4, PO6, PO11
2	Inorganic Compounds and Their Environmental Impact	PO1, PO6, PO11

12. Proposed Activity:

Sr. No.	Type of Activity	Topics	Tentative Date
1	Guest Lecture	Principles and Concepts of Green Chemistry	13.12.24
2	Guest Lecture	Recent Advancements in Organometallic Chemistry	14.01.24
3	Workshop	Hands-on Training of Basic Chemistry Softwares	22.01.24

13. Evaluation Scheme:

The marks allocated for continuous mode of internal assessment shall be awarded for attendance, academic activities and student-teacher interaction. Two sessional exams shall be conducted during mid of the semester. The average marks of two sessional exams shall be computed for internal assessment. Sessional exam shall be conducted for 30 marks and shall be computed for 15 marks. Weightage for various evaluation components is as below:

Sr. No.	Evaluation Component	Weightage
1	Internal Assessment 1. Continuous Mode 2. Sessional Exams	 10 15
2	End Semester Exam	75
	Total	**100**

s per PCI and University guidelines minimum 75% attendance is required to become eligible for appearing in the End Semester Examination.

This document is approved by:

Designation	Name	Signature
Course Coordinator		
HOD		
Principal		

ANNEXURE I: PROGRAM OUTCOMES

1. **Pharmacy knowledge:** Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.
2. **Planning abilities:** Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.
3. **Problem analysis:** Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.
4. **Modern tool usage:** Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.
5. **Leadership skills:** Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.
6. **Professional identity:** Understand, analyze and communicate the value of their professional roles in society (e.g., health care professionals, promoters of health, educators, managers, employers, employees).
7. **Pharmaceutical ethics:** Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.
8. **Communication:** Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.
9. **The pharmacist and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

10. **Environment and sustainability:** Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
11. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.