

## **COURSE HANDOUT**

### **PHARMACEUTICAL ANALYSIS I (THEORY)**

**COURSE CODE: BP102T**

#### **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.

<b>Programme Name</b>	Bachelor of Pharmacy (B. Pharmacy)
<b>Course Name</b>	Pharmaceutical Analysis-I (Theory)
<b>Course Code</b>	BP102T
<b>Session</b>	
<b>Semester</b>	I
<b>Lecture/Tutorial (Per Week)</b>	3 (3-1-0)
<b>Course Credit</b>	4
<b>Course Coordinator Name</b>	

#### **1. Scope of the Course:**

This course provides students with a robust foundation in analytical chemistry and equip them with the skills needed to excel in the pharmaceutical industry by ensuring the quality, safety, and efficacy of drugs and pharmaceutical products.

#### **Course Outcomes (COs):**

- 102.1.** Demonstrate the different analytical techniques, scope of analysis, computation of analytical results and various methods of expressing the concentration.
- 102.2.** Gain the cite of fundamental concept of acid base, aqueous and non-aqueous titration and their role in the study of purity profile of drugs.
- 102.3.** Learn the different volumetric analytical methods such as precipitation, gravimetric and complexometric titration for the quantitative estimation of active pharmaceutical ingredients
- 102.4.** Understand the basic principles of redox titration and their significant role in the quantitative analysis of pharmaceutical ingredients.
- 102.5.** Use factual background knowledge in various electroanalytical methods (such as potentiometry, conductometry and polarography).

#### **2. Text Books:**

- TB1: Kar A. Pharmaceutical Drug Analysis. New Age International Publishers, New Delhi.
- TB2: Vogel AI. Textbook of Quantitative Inorganic Analysis. Pearson, New Delhi.
- TB3: Kamboj PC. Pharmaceutical Analysis. Volume I. Vallabh Publications, New Delhi.
- TB4: Shankar SR. Textbook of Pharmaceutical Analysis. Rx Publications, Tirunelveli.

#### **3. Reference Books:**

- RB1: Indian Pharmacopoeia. The controller of Publications, Delhi.
- RB2: Vogel's Textbook of Chemical Analysis. Sixth edition, Pearson, New Delhi.

- RB3: British Pharmacopoeia. Her Majesty's Stationary Office, University Press, Cambridge.

#### 4. Other Readings & Relevant Websites:

Sr. No.	Link of Journals, Magazines, Websites and Research Papers
1	<a href="https://www.slideshare.net/">https://www.slideshare.net/</a>
2	<a href="https://www.researchgate.net/">https://www.researchgate.net/</a>
3	<a href="https://www.pharmatutor.org/">https://www.pharmatutor.org/</a>
4	<a href="https://www.journals.elsevier.com/journal-of-pharmaceutical-and-biomedical-analysis/">https://www.journals.elsevier.com/journal-of-pharmaceutical-and-biomedical-analysis/</a>

#### 5. Course Plan:

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

Subject: Pharmaceutical Analysis-I (Theory)		Subject Code: BP102T
Sr. No.	Topics	No. of Lectures
1	<p><b>(a) Pharmaceutical analysis-</b> Definition and scope</p> <p>i) Different techniques of analysis</p> <p>ii) Methods of expressing concentration</p> <p>iii) Primary and secondary standards.</p> <p>iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate</p> <p><b>(b) Errors:</b> Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures. Pharmacopoeia, Sources of impurities in medicinal agents, Limit tests.</p>	10
2	<p><b>Acid-base titration:</b> 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.</p> <p><b>Non-aqueous titration:</b> Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl.</p>	10
<b>ST-I (Syllabus Covered from Lecture 01 to 20)</b>		
3	<p><b>Precipitation titrations:</b> Mohr's method, Volhard's, Modified Volhard's, Fajan's method, estimation of sodium chloride.</p> <p><b>Complexometric titration:</b> Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.</p> <p><b>Gravimetry:</b> Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post-precipitation, Estimation of barium sulphate.</p> <p><b>Diazotization titrations:</b> Principle, methods and applications</p>	10
4	<p><b>Redox titrations</b></p> <p>(a) Concepts of oxidation and reduction</p> <p>(b) Types of redox titrations (Principles and applications)</p> <p>Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with Potassium Iodate.</p>	08
5	<p><b>Electrochemical methods of analysis</b></p> <p><b>Conductometry-</b> Introduction, Conductivity cell, Conductometric titrations, applications.</p> <p><b>Potentiometry</b> - 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.</p> <p><b>Polarography</b> - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications.</p>	07
<b>ST- II (Syllabus Covered from Lecture 21 to 45)</b>		

#### 6. Lecture Plan:

Sr. No.	Topics	Dates (tentative)		CO
		Section A	Section	

			<b>B</b>	
01	Definition, scope of analysis	11.09.23	12.09.23	102.1
02	Different techniques of Analysis	14.09.23	13.09.23	102.1
03	Methods of expressing concentrations, primary and secondary standards	15.09.23	15.09.23	102.1
04	Preparation and standardization of oxalic acid, sodium hydroxide, hydrochloric acid	18.09.23	19.09.23	102.1
05	Preparation and standardization of sodium thiosulphate, sulphuric acid, potassium permanganate, and ceric ammonium sulphate	21.09.23	20.09.23	102.1
06	Sources and classification of errors, methods of minimizing errors	22.09.23	22.09.23	102.1
07	Introduction to pharmacopoeias	25.09.23	26.09.23	102.1
08	Sources of impurities, limit test for chlorides, sulphates	28.09.23	27.09.23	102.1
09	Limit test of arsenic, heavy metals	29.09.23	29.09.23	102.1
10	Test as per CO-1	05.10.23	03.10.23	102.1
11	Introduction, acid base theories, neutralization indicators and theories associated	06.10.23	04.10.23	102.2
12	Neutralization curves of strong, weak acids and bases	09.10.23	06.10.23	102.2
13	Choice of indicator and neutralization curves	12.10.23	07.10.23	102.2
14	Introduction to non aqueous titration	13.10.23	11.10.23	102.2
15	Classification of non aqueous titration	16.10.23	13.10.23	102.2
16	Acidimetry and alkalimetry	19.10.23	17.10.23	102.2
17	Types of non aqueous solvents	20.10.23	18.10.23	102.2
18	Levelling effect and differentiating solvents	23.10.23	20.10.23	102.2
19	Estimation of sodium benzoate and ephedrine HCl	26.10.23	25.10.23	102.2
20	Test as per CO-2	27.10.23	27.10.23	102.2
21	Precipitation titrations, Mohr method, Volhard method	30.10.23	31.10.23	102.3
22	Fajan method, estimation of Sodium Chloride	02.11.23	03.11.23	102.3
23	Introduction to complexometric titration, classification	03.11.23	07.11.23	102.3
24	Metal ion indicators, masking and demasking reagents,	06.11.23	08.11.23	102.3
25	Estimation of magnesium sulphate and calcium gluconate	09.11.23	28.11.23	102.3
26	Principle and steps involved in gravimetric analysis	30.11.23	29.11.23	102.3
27	Principle and steps involved in gravimetric analysis	01.12.23	01.12.23	102.3
28	Purity of precipitate	04.12.23	05.12.23	102.3
29	Estimation of barium sulphate	07.12.23	06.12.23	102.3
30	Test as per CO-3	08.12.23	08.12.23	102.3
31	Concept of oxidation and reduction	11.12.23	12.12.23	102.4
32	Indicators used in redox titration and its significance	14.12.23	13.12.23	102.4
33	Types of redox titrations	15.12.23	15.12.23	102.4
34	Cerimetry, iodimetry	18.12.23	19.12.23	102.4
35	Iodometry, bromatometry	21.12.23	20.12.23	102.4
36	Titration with potassium iodate	22.12.23	22.12.23	102.4
37	Principles and applications of dichrometry	08.01.24	09.01.24	102.4
38	Test as per CO-4	11.01.24	10.01.24	102.4
39	Introduction to conductometry, different types of conductivity cells	12.01.24	12.01.24	102.5
40	Types of conductometric titrations, applications of conductometry	15.01.24	16.01.24	102.5
41	Electrochemical cell, construction and working of reference and indicator electrodes	18.01.24	19.01.24	102.5
42	Methods to determine end point of potentiometric titration, applications of potentiometry	19.01.24	23.01.24	102.5
43	Principle of polarography, Ilkovic equation, basic of electrodes use in polarography	22.01.24	24.01.24	102.5
44	Construction and working of dropping mercury electrode and rotating platinum electrode, applications of polarography	25.01.24	30.01.24	102.5
45	Test as per CO-5	29.01.24	31.01.24	102.5

## 7. Tutorial Plan

Tutorial No.	Topic	Tentative date
1	Primary and secondary standards	13.09.23
2	Errors, sources of errors, method of minimizing errors	20.09.23
3	Limit test of chloride, sulphate, arsenic and heavy metals	27.09.23
4	Theories of acid base indicators	04.10.23
5	Neutralization curves	11.10.23
6	Acidimetry and alkalimetry	18.10.23
7	Mohr Method, Volhard Method, Fajan method	25.10.23
8	Metal ion indicators	08.11.23
9	Co-precipitation and post-precipitation	29.11.23
10	Diazotization titrations	06.12.23
11	Concept of oxidation and reduction	13.12.23
12	Principles and applications of Iodimetry and iodometry	20.12.23
13	Types of conductometric titrations	10.01.24
14	Construction and working of references electrodes in potentiometry	24.01.24
15	Construction and working of standard electrodes in potentiometry	31.01.24

## 8. Assignments Plan:

Sr. No.	Type of Assignment	Assignment	Marks	CO	PO (Annexure I)	Tentative Date
1	Problem solving	Preparation and standardization of various molar and normal solution	10	102.1	PO1, PO6, PO11	05.10.23
2	Reasoning	Use of various indicators in strong acid and strong acids, strong acid and weak base, weak base and strong acid with help of neutralisation curve	10	102.2	PO1, PO6, PO11	27.10.23
3	Critical Thinking	Research and discuss the advantages and limitations of Mohr's method compared to Volhard's method for the estimation of chloride ions. When would you choose one over the other?	10	102.3	PO1, PO4, PO6, PO11	06.12.24
4	Survey	Assay of five ingredients in market formulations using redox titration (principle, reaction and reagents)	10	102.4	PO1, PO6, PO11	09.01.24
5	Open book assignment	Applications of conductometry, potentiometry and polarography in quantitative analysis of pharmaceutical products	10	102.5	PO1, PO4, PO6, PO11	31.01.24

## 9. Class Tests Schedule:

Sr. No.	Test Type	Topics	Marks	CO	PO (Annexure I)	Tentative Date
1	Subjective	Errors, its classification and sources of errors; primary and secondary standards	10	102.1	PO1, PO3, PO6, PO8, PO11	05.10.23 03.10.23
2	Subjective	Acid base titrations Non aqueous titrations	10	102.2	PO1, PO3, PO6, PO8, PO11	27.10.23
3	Subjective	Complexometric titrations Precipitation titration	10	102.3	PO1, PO3, PO6, PO8, PO11	09.11.23 08.11.23
4	Subjective	Redox titration Working and applications of various types of redox titrations	10	102.4	PO1, PO3, PO6, PO8, PO11	11.01.24 09.01.24

5	Subjective	Conductometry Potentiometry	10	102.5	PO1, PO3, PO6, PO8, PO11	29.01.24 30.01.24
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#### 10. Content Beyond Syllabus (CBS):

Sr. No.	Topics	PO to be Achieved (Annexure I)
1	Applications of different types of titrations in market formulations	PO1, PO4, PO6, PO11
2	Importance of quality control department in industry	PO1, PO6, PO11

#### 11. Proposed Activity:

Sr. No.	Type of Activity	Topics	Tentative Date
1	Guest Lecture	Utilisation of analytical techniques in pharmaceutical industry	02.02.24

#### 12. Evaluation Scheme:

The marks allocated for the 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. The 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
	<b>Total</b>	<b>100</b>

As 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.