P.B.SIDDHARTHA COLLEGE OF ARTS & SCIENCE
DEPARTMENT OF CHEMISTRY
M.Sc – CHEMISTRY (ORGANIC CHEMISTRY)

II SEMESTER
W.E.F 2022-23 (R22 Regulations)

Title of the Paper: INSTRUMENTAL METHODS OF ANALYSIS

Course Code	**22CH2E2**	Course Delivery Method	Class Room / Blended Mode - Both
Credits	**4**	CIA Marks	30
No. of Lecture Hours / Week	**4**	Semester End Exam Marks	70
Total Number of Lecture Hours	**60**	Total Marks	100
Year of Introduction:2017-2018	Year of Offering:	Year of Revision:----	Percentage of Revision: ---

S.No	COURSE OUTCOMES	PO`S
	After the completion of the course, Students will be able to	
1	Memorize the basic principles of the modern methods of analysis.	2,7
2	Understand the basic and advanced concepts of modern methods (i.e Instrumental methods) of analysis.	1,2,7
3	Apply the instrumental methods of analysis in any chosen job role.	1,4,5
4	Interpret the role of these instrumental methods in the quantitative determination of constituents.	1,3,6

Syllabus

Unit	Learning Units	Lecture Hours
I	**Spectro-analytical methods of analysis**: **Flame photometry:** Theory, instrumentation, combustion flames, detectors and analysis of Na, K, Ca, Mg. **Atomic Absorption Spectrometer:** theory, instrumentation, flame and non-flame techniques, resonance line sources, hollow cathode lamp, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water andeffluents. **Inductively coupled plasma spectrometer (ICP-AES, ICP-MS):** Principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, difference between the two detectors, applications.	12
II	**Thermal methods of Analysis: Thermo gravimetry**: Theory, instrumentation, applications with special reference to $CuSO_4.5H_2O$, $CaC_2O_4.2H_2O$, $CaCO_3$, $(COOH)2.2H2O$ **Differential thermal analysis:** Principle, instrumentation, difference between TG and DTA - applications with special reference to the clays and minerals, coals (fuels). **Differential scanning calorimetry :** Principle, instrumentation, applications to inorganic materials like chlorates and per	12

	chlorates, ammonium nitrate, organic compoundsand drugs.	
III	**Electro analytical Methods-1: Polarographic analysis**: Principle and Instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn, AC polarography, pulse polarography. **Anode stripping voltametry**: Principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.	12
IV	**Electro analytical methods -2Electro gravimetric analysis**: Principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of Cu^{2+} by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis. **Coulometric analysis**: Principles of coulometric analysis with constant current and controlled potential, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations- As(III), Fe(II) and $I^-$and $S^{2-}$by using I_2 liberations and Ce^{4+} liberation in solutions.	12
V	**Electro analytical methods -3 Amperometry:** Introduction, principle, conditions for performing amperometric titrations, advantages, titrations with rotating platinum electrode, applications. **Biamperometry:** Principle, biamperometric titrations and its curves, applications. **Cyclic voltametry:** Basic principles, applications.	12

Reference books:

1. Instrumental methods of analysis - H.H Willard, Meritt Jr. and J.ADean.
2. Principles of instrumental analysis - Skoog and West.
3. Vogel's Textbook of Quantitative Inorganic analysis - J. Basset, R.C. Denney, G.H. Jeffereyand J.Madhan.
4. Instrumental methods of analysis - B.K Sarma, Goel Publishing House,Meerut.
5. Instrumental methods of Analysis - Chatwal andAnand.
6. Instrumental methods of Analysis - Ewing W. Wendtland.
7. Thermal Analysis, John Wiley Sons, New York.

M.Sc. DEGREE EXAMINATION
SECOND SEMESTER
Course Code : 22CH2E2

Elective Paper:: Instrumental Methods of Analysis

Time: 3 hours ***Maximum Marks: 70***

SECTION – A **(5x4M=20M)**

1 (a). Explain briefly the analysis of Na, K, Ca, Mg by using Flame photometry. (CO-2, L-2)

(Or)

(b). Discuss the theory involved in AAS. (CO-2, L-2)

2 (a). Elaborate the theory in TG. (CO-2, L-2)

(Or)

(b). Describe the principle involved in Differential Scanning Calorimetry . (CO-2, L-2)

3(a). Explain instrumentation of dropping mercury electrode. (CO-2, L-2)

(Or)

(b). Write about Cathode Stripping Voltametry. (CO-2, L-2)

4(a). Discuss briefly the important terms in electro gravimetry. (CO-2, L-2)

(Or)

(b). Explain determination of Cu, Pb by controlled potential electrolysis. (CO-2, L-2)

5 (a). What are amperometric titrations? Describe the advantages of amperometric titrations. (CO-2, L-2)

(Or)

(b). Discuss briefly the theory of Cyclic Voltametry. (CO-2, L-2)

SECTION – B **(5x10M=50M)**

UNIT - I

6.(a) Elucidate the instrumentation& Principle of AAS in detail. (CO-2, L-2)

(Or)

(b) Discuss the instrumentation of ICP-AES, ICP-MS in detail. (CO-2, L-2)

UNIT – II

7.(a) Illustrate Themo gravimetry applications of $CuSO_4.5H_2O$,$CaC_2O_4.2H_2O$,$CaCO_3$. (CO-3, L-3)

(Or)

(b) Write a note on applications of DSC to inorganic materials. (CO-3, L-3)

UNIT – III

8.(a) Discuss the principle and instrumentation of Anode stripping voltametry (CO-2, L-2)

(Or)

(b) Explain the advantages and disadvantages of DME. (CO-2, L-2)

UNIT - IV

9.(a) What is the importance of decomposition potential, over voltage. (CO-2, L-2)

(b) Explain the instrumentation of Electro gravimetry. (CO-2, L-2)

(Or)

(c) Write a note on coulometric analysis of cations-As(III), Fe(II), I^- and S^{2-} by using I_2 liberation and Ce^{4+} liberation in solutions. (CO-2, L-2)

UNIT - V

10.(a) What are the conditions for performing amperometric titrations, biamperometric titrations. (CO-2, L-2)

(Or)

(b) Discuss the advantages and applications of amperometric titrations (CO-2, L -2)