SEMESTER S8

ANALYTICAL INSTRUMENTATION

Course Code	PEEIT862	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To review background information required for studying analytical instrumentation.
2. To study the basic building blocks of analytical instrumentation.
3. To study a few applications in analytical instrumentation

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	**Introduction to Analytical Instrumentation** Fundamentals of analytical instruments: Elements of an analytical instrument – PC based analytical instruments –Classification of instrumental techniques. Electromagnetic radiation- Electromagnetic spectrum- Laws relating to absorption of radiation. Absorption spectroscopy: Absorption instruments:Radiation sources- Optical filters- Monochromators- Detectors. **Ultra violet and visible absorption spectroscopy.Colorimeters/ photometers**: Single beam and double beam filter photometer – Spectro photometers: Single beam andouble beam spectro photo meters	9
2	Infra red spectroscopy: Basic components- Radiation sources- Monochromators- Detectors. Flame Photometry: Principle and constructional details of flame photometer- Emission system – Optical system – Detectors. Atomic absorption spectrophotometers:Theoretical concepts, Instrumentation: Radiation sources -Burners and flames - Plasma excitation sources - Fluorescence spectroscopy: Principle of fluorescence –	9

	Measurement of fluorescence – Single beam and double beam filter fluorimeter- Ratio fluorimeter. Spectro fluorimeters.	
3	Raman spectrometer- Basic theory-. Mass spectrometer: Principle of operation- Magnetic deflection mass spectrometers- Components of a mass spectrometer – Nuclear Magnetic Resonance spectroscopy: Basic principle – Constructional details of NMR spectrometer – Nuclear radiation detectors. Electron Spin Resonance spectrometer: Basic ESR spectrometer – Electron spectroscopy: Instrumentation for electron spectroscopy.X- Ray spectrometers: X – ray spectrum –Instrumentation for x –ray spectrometry.	**9**
4	Industrial Gas analyzers- pH meters- Conductivity meters - Dissolved oxygen meters- Sodium analyser– Gas analysers- Paramagnetic oxygen analyser – CO analysers – Chromatography: Chromatographic process – Classification- Terms in chromatography- Gas chromatography: Block diagram- Principle - Constructional details – Column details- GC detectors. Liquid Chromatography: Types of liquid chromatography- High pressure Liquid Chromatography (HPLC): Principle- Constructional details.	**9**

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Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Recall the fundamentals of electromagnetic radiation and associated laws such as Lamberts law ,Beer law and beer lamberts law	**K2**
CO2	Explain fundamentals of analytical instrumentation and various spectroscopic techniques for both qualitative and quantitative analysis of solution.	**K2**
CO3	Discuss the components which are used in spectroscopic techniques such as radiation sources,optical arrangements,detectors etc,.	**K2**
CO4	Describe the chromatographic technique for the analysis of given chemical solution.	**K2**
CO5	llustrate the working principle of gas analyser ,pH meter,conductivity meter .	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	2	3										1
CO3	1	3										1
CO4	-	2										1
CO5	2	2										1

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

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Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	"Principles of Instrumental Analysis"	Skoog, Holler, Nieman	Thomson books-cole publications	5th edition.
2	"Handbook of Analytical Instruments"	R. S. Khandpur	Tata McGraw–Hill Publications	3rd edition
3	, "Instrumental Methods of Analysis",	Willard, Merritt Dean, Settle	CBS Publishers & Distributors, New Delhi,	Seventh edition.

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	"Instrumental Methods of Chemical Analysis"	Galen W. Ewing	McGraw-Hill Book Company,	Fifth edition.
2	"Introduction to Instrumental Analysis"	Robert D. Braun	McGraw-Hill Book Company	Fifth edition.

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
NPTEL	Modern Instrumental Methods of Analysis, IISc Bangalore Dr. J.R. Mudakavi