

Subject Code	18 EI/BM/ML 46		CIE Marks	: 40
Number of Lecture + Tutorial Hours/Week	: 02+02		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits - 3				
Course Learning Objectives:				
<ul style="list-style-type: none"> • To introduce the basic concept of qualitative and quantitative analysis of a given sample. • To impart various spectroscopic techniques and its instrumentation. • To impart the concept of separation science and its application. • To impart methods of Industrial analyzers and its application. 				
Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating				
Modules			Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 An Introduction to Instrumental Methods: Terms associated with Chemical analysis, Classification of instrumental techniques, A review of important consideration in analytical methods, Basic functions of instrumentation, Fundamental Laws of photometry (Text book 1). IR Spectroscopy: Basic Components of IR Spectrophotometers, monochromators- Littrow mounting, Fourier Transform IR Spectroscopy (Text book 2).			08 Hours	L1, L2
Module -2 UV and Visible Spectrometers –Instrumentation: Radiation Sources, Wavelength selection: absorption filters, interference filters, Detector, Readout modules (Text book 1), Instruments for absorption photometry: single beam and double beam spectrophotometer. (Text book 2)			08 Hours	L1, L2
Module -3 Flame Emission and Atomic Absorption Spectroscopy: Introduction, Instrumentation for flame spectrometric methods, Flame emission spectrometry, atomic absorption spectrometry, Atomic fluorescence spectrometry, Interferences associated with Flames & furnaces, applications, comparison of FES and AAS. (Text book 1).			08 Hours	L1, L2
Module -4 Gas Chromatography: Chromatograph, Basics parts of a chromatograph: carrier gas supply, sample injection system, chromatographic columns: packed column & capillary column, Detectors: katharometer cell, differential flame ionization detector, electron capture detector. (Text book 2). HPLC Instrumentation: Mobile –phase delivery system sample introduction, separation of columns, Detectors– Ultraviolet Photometers & Spectrophotometers, electrochemical detector (amperometric detector), Differential refractometer. (Text book 1).			08 Hours	L1, L2, L3

<p>Module -5 Blood analyzer: Introduction, Blood pH measurements: electrodes for blood pH measurement, measurement of blood pCO₂, pO₂ , A Complete blood gas analyzer. Air pollution monitoring instruments: Carbon monoxide (CO) -Non-dispersive infrared analyzer, Sulphur dioxide (SO₂)-Conductivitymetry, UV fluorescence method, Nitrogen oxides-Using CO laser, laser opto-acoustic spectroscopy, Hydrocarbons-Flame ionization detector, Ozone-Chemiluminescence, Automated wet chemical air analysis, Water pollution monitoring instruments. (Text book 2)</p>	<p>08 Hours</p>	<p>L1, L2, L3, L4</p>
<p>Course Outcomes:</p> <ol style="list-style-type: none"> 1. The students get well versed with the principle, construction and working of various analytical instrumentation. 2. Students get detailed information about the application of analytical techniques in medicine, Industry, etc. 		
<p>Graduate Attributes (as per NBA)</p> <ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Life-long Learning 		
<p>Question Paper Pattern:</p> <ul style="list-style-type: none"> • The question paper will have TEN questions. • Each full question carry 20 marks • There will be TWO full questions (with maximum of THREE sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting ONE full question from each module. 		
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Instrumental Methods of Analysis, 7th edition. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS Publishing & Distribution (Module 1, Module 2, Module 3, Module 4HPLC) 2. Handbook of Instruments – R.S. Khandpur, Tata McGraw Hill (Module 1-IR Spectroscopy, Module 4, Module 5) 		
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Braun R.D., Introduction to Instrumental Analysis, McGraw –Hill Singapore,2006. 2. Frank G. Kerry Industrial Gas Handbook: Gas Separation and Purification, Taylor and francis group, 2007. 3. Principles of Instrumental Analysis 5th Edition – Douglas A. Skoog, F. James Holler, Timothy A. Niemen, Thomason Brooks/ Cole 		

<p>B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - IV</p>
<p>Embedded Controllers Lab (Common to EI, BM & ML)</p>