Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER EXAMINATIONS, APRIL/MAY 2024

MATERIAL SCIENCE AND ENGINEERING
Semester IV
ML 5401 Experimental Techniques and Methods
(Regulation 2019)

Time: 3 hrs Max. Marks: 100

CO1 To understand the fundamental concepts and principles of spectroscopy
CO2 To use uv-visible, IR, Raman & Atomic spectroscopic techniques for material characterization
CO3 To evaluate thermal and surface characteristics of materials using analytical methods
CO4 To qualitatively and quantitatively estimate samples using separation techniques
CO5 To interpret the results of spectroscopic and analytical methods of specimen analysis

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART - A (10 x 2 = 20 Marks)

(Answer all Questions)

Q.No	Questions	Marks	CO	BL
1	State the principle of absorption spectroscopy.	2	1	1
2	What is the basis of spark emission spectroscopy?	2	1	2
3	State the usefulness of Woodward Fieser rule.	2	2	1
4	Calculate the number of fundamental vibrational modes in a molecule with 5 atoms.	2	2	2
5	Write the basic steps involved in FES.	2	3	1
6	Comment on the benefits of hollow cathode lamp.	2	3	2
7	List the essential components of a GC.	2	4	1
8	Why reverse phase chromatography is widely used?	2	4	2
9	Define electron number effect.	2	5	1
10	Draw the electron-specimen interaction zone and label.	2	5	2

PART- B (5 x 13 = 65 Marks)

Q.No	Questions	Marks	CO	BL
11 (a)	(i) What is a transition? What are its types? Explain. (10) (ii) State the Beer Lambert's law and mention its limitations. (3)	13	1	4
	OR			
11 (b)	(i) Distinguish the following combinations: (5 x 2 = 10) • Singlet ground state and Singlet excited state • Fluorescence, phosphorescence and chemiluminescence • IR, Raman and UV-visible spectroscopy • Rayleigh, stokes and antistokes scattering • Absorption, emission and scattering spectroscopy (ii) Write a note on Auger effect. (3)	13	1	4

12 (a)	(i) With a neat diagram, explain the working of an interference filter. (10) (ii) Write a note on PMT. (3)	**13**	2	4
	OR			
12 (b)	(i) With a neat sketch, explain the construction and working of a photovoltaic cell. (10) (ii) Write a note on photometric titration. (3)	**13**	2	4
13(a)	(i) With a neat sketch explain the working principle of AAS. What are the potential uses, advantages and limitations of the technique? (10) (ii) Appraise the advantages of FTIR? (3)	**13**	3	4
	OR			
13(b)	(i) Discuss the factors that affect the bond energy of a molecule with examples. (10) (ii) How samples are prepared for IR analysis? (3)	**13**	3	4
14 (a)	(i) Distinguish between (2 x 5 = 10) • TLC and paper chromatography • TCD and ECD (ii) Brief on the factors that influence the Rf value. (3)	**13**	4	3
	OR			
14 (b)	(i) Distinguish between: (2 x 5 = 10) • Ion exchange and reverse phase chromatography • GSC and GLC (ii) Brief on the types of forces that act upon in a paper chromatography method. (3)	**13**	4	3
15 (a)	(i) Distinguish between: (2 x 5 = 10) • DSC and TGA • W and LaB_6 guns (ii) Briefly explain the modes of AFM. (3)	**13**	5	3
	OR			
15 (b)	(iii) (i) Distinguish between: (2 x 5 = 10) • Ultramicrotomy and Electrolytic thinning • SEM and TEM (ii) Briefly explain the features of DMA. (3)	**13**	5	3

PART- C (1 x 15 = 15 Marks)3

(Q.No.16 is compulsory)

Q.No	Questions	Marks	CO	BL
16 (i)	With a suitable case study, explain the use of IR spectroscopy.	**5**	5	6
(ii)	Draw a typical DSC curve and explain the various thermal transitions with two examples.	**5**	5	6
(iii)	Match the following and justify.	**5**	5	6

FTIR	Thermal stability
FES	Tg
ICP-AES	Multiple element determination
DSC	Group I, II elemental analysis
TGA	Finger Print Region