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B.M.S. College of Engineering, Bengaluru-560019

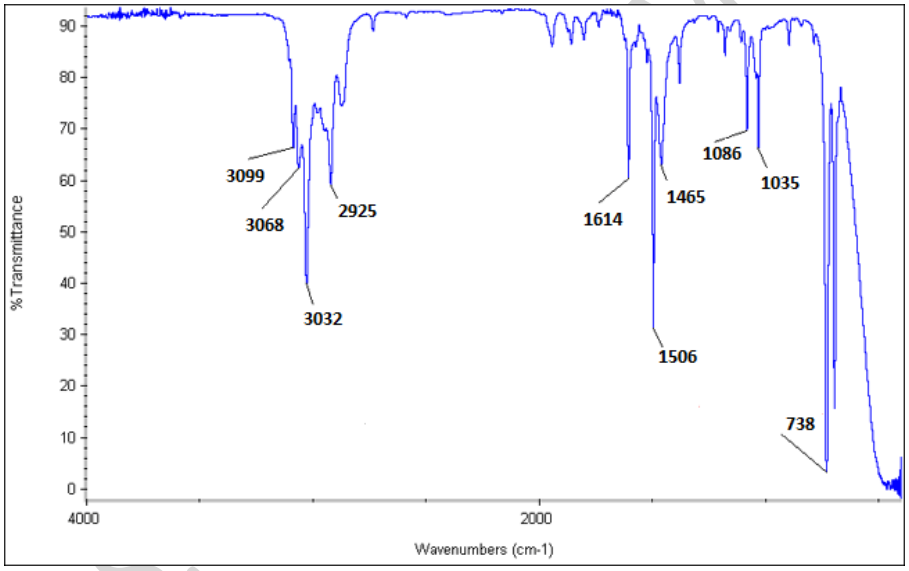
Autonomous Institute Affiliated to VTU

July 2023 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 22ME6OEMAC **Max Marks: 100**
Course: Material Characterization **Date: 07.07.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Draw relevant diagrams/graphs and give equations wherever necessary.
4. Can carry and use IR spectroscopy/XRD handbook sealed by department.

			UNIT - I	CO	PO	Marks
1	a)		Draw the following crystal conditions (i) Hexagonal (ii) Simple Orthorhombic (iii) FCC (iv) 100 (v) 110 (vi) 111	*CO1*	*PO1*	**06**
	b)		Explain the working and construction of x-ray generation tube.	*CO1*	*PO1*	**06**
	c)		Explain the generation of continuous and characteristic spectra of X-ray.	*CO1*	*PO1*	**08**
			OR			
2	a)		The 2θ values for the powder diffraction peaks of a substance is given below: **Peak No.** 1 2 3 4 5 6 7 8 **2θ, deg** 36.7 42.67 61.85 74.1 77.98 93.3 104.76 108.66 The patterns are obtained using Cu - K_α radiation (λ = 1.542 *Å*). (i) Identify the crystal structure, (ii) Index the patterns, (iii) Determine the *d*-spacing, and (iv) Calculate the lattice parameter.	*CO6*	*PO2*	**08**
	b)		Explain any four factors that influence the diffracted X-ray intensity.	*CO1*	*PO1*	**08**
	c)		Mention X-ray diffraction methods and their diffraction conditions (X-ray type, wavelength, Bragg angle).	*CO1*	*PO1*	**04**
			UNIT - II			
3	a)		Describe the structure and working of transmission electron microscope (TEM).	*CO2*	*PO1*	**08**
	b)		Explain bright-field and dark-field imaging modes in TEM.	*CO2*	*PO1*	**10**
	c)		Mention any two TEM specimen preparation technique used for non-conductive specimens.	*CO2*	*PO1*	**02**
			OR			

	4	a)	Explain secondary electron and back-scattered electron modes of imaging in scanning electron microscope (SEM).	*CO2*	*PO1*	**08**
		b)	Explain the effect of working distance and spot size on SEM imaging.	*CO2*	*PO1*	**08**
		c)	Write a note on dehydration specimen preparation technique in SEM.	*CO2*	*PO1*	**04**
			UNIT - III			
	5	a)	Explain the interpretation of thermogravimetry curves.	*CO3*	*PO1*	**08**
		b)	Explain the structure and working of dynamic mechanical thermal analyzer (DMA). Mention any two applications of DMA.	*CO3*	*PO1*	**10**
		c)	Define viscoelastic materials. Mention one of its significances in industry.	*CO3*	*PO1*	**02**
			UNIT - IV			
	6	a)	Discuss the structure and working of double beam infrared (IR) spectroscopy. Mention any two techniques for reflectance/emission measurements	*CO4*	*PO1*	**08**
		b)	Index the significant peaks (at least five) of IR spectrum below, and comment on the plausible structure of molecule. 	*CO6*	*PO2*	**06**
		c)	Explain the atomization process in flame atomic absorption spectrometry.	*CO4*	*PO1*	**06**
			UNIT - V			
	7	a)	Explain the structure and working of x-ray photoelectron spectroscopy (XPS).	*CO5*	*PO1*	**08**
		b)	Draw six differences between scanning tunneling microscope and atomic force microscope (AFM).	*C 5*	*PO1*	**06**
		c)	Discuss any six differences between SEM and AFM.	*CO5*	*PO1*	**06**

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