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Exam.Code:1029
Sub. Code: 7852 ✓

1128
M. Tech. (Material Science and Technology)
First Semester
MST-102: Material Characterization

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.

x-x-x

Q1. Attempt the following: (This question is compulsory)

- What are the uses of evolved gas analysis in Thermogravimetric Analysis?
- What are the disadvantages of penning gauge?
- What is the reason for absence of (100) reflection in b.c.c. lattice?
- What is the purpose of using gas ballast valve in rotary vacuum pump?
- What is chemical vapor deposition?
- What do mean by shape coefficient of a particle?
- How the Primary, Secondary and tertiary alcohols will classified with the help of IR spectroscopy?
- Why homonuclear diatomic molecules are IR inactive and Raman active?
- What do you mean by augur electrons?
- What is difference between Rayleigh and Raman scattering?

(1x10=10)

PART A

- Q2. (a) What is molecular beam epitaxial technique? How the molecular beams are produced? Explain the principle and working of molecular beam epitaxy? (5)
(b) What is turbo-molecular pump? Define the principle, construction and working of turbo-molecular pump with neat and clean diagram. (5)
- Q3. (a) Discuss the variation of intensity with the half scattering angle (θ), include the effects of the lattice-structure factor, the geometrical structure factor and the electron scattering length. (4)
(b) Describe powder method of X-ray diffraction and explain how it is used for determination of crystal structure. (4)
(c) Bragg found that (100), (110) and (111) planes of KCl crystal give strong reflections of an X-ray beam at angles $5^\circ 23'$, $7^\circ 37'$, $9^\circ 25'$ respectively. Show it has a simple cube structure. (2)
- Q4. (a) Explain the types and working of Differential scanning calorimetry? What information you can extract from a typical DSC curve? (5)
(b) Discuss the principle and working of thermogravimetric analysis. How the instrumental factor and sample characteristics affect the TG curve? (5)

PART B

- Q5. (a) Discuss FTIR spectroscopy with reference to IR region. What are the various factors which influence the vibrational frequency of a particular group? Which selection rule is used in IR spectroscopy? (5)
(b) What is Franck-Condon principle? Explain all the emission process occurring in Jablonski's energy diagram. How is it used for explaining fluorescence and phosphorescence? (5)
- Q6. (a) Discuss the principle of wavelength dispersive X-ray fluorescence? What types of X-ray source, Detector and filters used in the instrumentation of WDS? (6)
(b) Discuss the instrumentation of Raman Spectroscopy (4)
- Q7. Explain the Interaction of an electron beam with a low and high Z material. (4)
(b) Define Feret's diameter for size determination of a particle? How it differ from Martin's diameter? (2)
(c) What are the decision rules for particle shape analysis (4)

x-x-x