Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **M.Sc.I**

FPYE1006

10th Semester Regular Examination 2018-19

ADVANCED CHARACTERIZATION TECHNIQUES

BRANCH : M.Sc.I(AP)

Time : 3 Hours

Max Marks : 70

Q.CODE : F083

Answer Question No.1 which is compulsory and any FIVE from the rest.

The figures in the right-hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) Mention few applications of UV –Visible Spectroscopy in material analysis.

b) The Bragg angle corresponding to the 1st order reflection from (111) plane in a cubic lattice is 45° when X-rays of wavelength 1.5Å is used for diffraction. Calculate inter atomic spacing?

c) What is back scattered electron, write about their role in SEM imaging.

d) Define a reciprocal lattice.

e) Define the Brillouin zones.

f) Write the difference between tapping mode and Contact mode in AFM.

g) What is advantage of using field emission source in electron microscopy?

h) What are advantages of Scanning electron microscopy over optical microscopy?

i) Outline the fundamental interaction that takes place between highly energetic electron beam and the conducting specimen in a Transmission electron microscope (TEM).

j) With a schematic diagram explain how the d spacing of a material can be estimated in case of TEM.

Q2 **a)** Discuss Laue method and Rotating crystal method of studying X-ray diffraction by crystal. **(8)**

b) State the Debye-Scherer formula and mention its significance. **(2)**

Q3 Derive Bragg's law. Compare the choice of X-ray, electron and neutron in crystal structure analysis. **(4+6)**

Q4 With a schematic diagram, explain basic component, principle operation of Transmission electron microscope (TEM). What is the information one can extract about a material using TEM? **(7+3)**

Q5 **a)** Write notes on Atomic form factor and geometrical structure factor. **(6)**

b) Find the structure factor for the BCC and FCC lattice with atoms at $(0,0,0)$ and $\left(\frac{1}{2},\frac{1}{2},\frac{1}{2}\right)$ position. **(4)**

Q6 **a)** With a schematic diagram, briefly describe operating principle of Atomic force microscopy (AFM). **(5)**

b) With a schematic diagram, briefly describe operating principle of Scanning Tunneling microscopy (STM). **(5)**

Q7 **a)** Discuss the principle and operation of a UV–Visible Spectrophotometer. **(5)**

b) Compare Raleigh scattering with Raman scattering. Discuss the operation of a Raman spectrometer **(2+3)**

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) Electron spectroscopy

b) X-ray photo electron Spectroscopy

c) Neutron-scattering

d) X-ray powder diffraction method.