Registration No :

Total Number of Pages : 02

M.Sc.
16MPYE406

4th Semester Regular Examination 2017-18
ADVANCE CHRACTERIZATION TECHNIQUES
BRANCH : M.Sc.(AP)
Time : 3 Hours
Max Marks : 70
Q.CODE : C255
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) Given that the primitive basis vectors of a lattice are a=(a/2)(i+j), b=(a/2)(j+k), and c=(a/2)(k+i), where i, j, and k are the usual three unit vectors along Cartesian coordinates , Identify the Bravais lattice?

b) Derive the reciprocal lattice vectors of the above mentioned Bravais lattice using the primitive basis vectors.

c) Calculate the inter planner distance of (111) planes of a simple cubic lattice of side length a.

d) Write down the list of seven crystal systems of the three dimensional Bravais lattice.

e) Briefly explain the difference between Rayleigh's scattering and Raman scattering.

f) Briefly describe the difference between thermionic and field emission electron sources used in SEM and FESEM respectively.

g) Write down the types of emissions happen from a material body when a high energetic beam of electron strikes.

h) What are the factors responsible for line broadening in UV Visible spectrum?

i) Briefly write what information one can get from X-Ray Photoelectron spectrum.

j) How does the tunnel current vary with the tip to surface distance in an STM?

Q2. **a)** Show that in an ideal hexagonal-close-packed structure, where the atomic sphere touches each other, the ratio c/a is given by c/a= $(8/3)^{1/2}$. **(5)**

b) Draw a Face-Centred-Cubic (FCC) structure and Calculate its packing fraction. **(5)**

Q3. **a)** Derive Bragg's law. **(5)**

b) Find the structural factor for Body-Centred-Cubic lattice assuming it as a cubic lattice with a basis of two points and also find the lattice planes from which Bragg reflection will occur. **(5)**

Q4. X-Ray diffraction peaks were observed at various angles from three different powder samples having FCC, BCC and Diamond crystal structures. The angles(2 theta in degree) are
Sample A: 42.2, 49.2, 72.0, 87.3
Sample B: 28.8, 41.0, 50.8, 59.6
Sample C: 42.8, 73.2, 89.0, 115.0
Identify the crystal structures of A, B, and C and the corresponding planes for the above mentioned peaks. **(10)**

Q5. Describe the function of different parts of a scanning electron microscope with schematic diagram. **(10)**

Q6. **a)** Describe different parts and their functioning of Atomic Force Microscope (AFM) with schematic diagram. **(7)**

b) Highlights the major differences in functioning between Scanning Tunnelling Microscope (STM) and AFM. **(3)**

Q7. Describe the various parts and their functioning of UV-visible spectrophotometer with schematic diagram. **(10)**

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

a) Compare the advantages and disadvantages of x ray, electron and neutron diffraction techniques.

b) What is Ewald construction? (Explain with diagram).

c) Explain Raman scattering with Schematic diagram.

d) Explain x-ray photoelectron spectroscopy with the energy level diagram.