MASTER OF BIO-MEDICAL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2024

FUNDAMENTALS OF BIOMATERIALS AND IMPLANTS

Time: 3h | Full Marks: 100

1. Answer total of ten marks from the followings 1X10=10
   i. Write biomedical application of following polymers: 1X3=3
      a. Polyethylene terephthalate
      b. Silicon rubber
      c. Poly styrene
   ii. Write application of the following polymer 1X3=3
      a. Poly acrylonitrile
      b. Polyvinylaccetate
      c. Polybutadiene
   iii. Answer the followings 1X4=4
      a. Write wavelength range of NMR
      b. Find the number of vibration modes of ethane.
      c. Name the termination processes for free radical polymerization.
      d. Which type of die one should use to get a pipe through extrusion?
   iv. Write True (T) / False (F) 1X4=4
      a. Implants provide function of Bone marrow also.
      b. Change in dipole is must for getting any IR signal from materials.
      c. Corrosion is a major problem for hip implants when ceramic is used.
      d. Ionized compound also obey Beer's –Lambert law.

3. Answer any nine questions:
   1. Discuss effect of heat on crosslinked and un-crosslinked polymers with example. What will be the effect of heat on calcium oxalate (gravimetric) describe with a graph. Why paraffin wax candle and plastic bottles has different physical state though they have made from same material polyethylene.
   2. Find atomic packing factor for FCC crystal. Draw [0 1 $\bar{1}$] and (1 $\bar{1}$ 0). Write axial relationship and inter axial angles of orthorhombic crystal system. 4+3+3
   3. Write short note on SEM including EDS. What are the differences between SEM and TEM? Write in short about the different types of optical microscopy present.
   4. Draw a figure to explain the probable exothermic & endothermic peaks of a DSC experiment. Draw thermogram of Calcium Oxalate Monohydrate and explain.
   5. Classify polymers based on line structure along with definition. A PVC sample has the following molecular weight distribution:

% mole of polymer	Molecular Weight
40%	40000
30%	30000
10%	2000
20%	1500

Find Mn, Mw, Polydispersity index.

6. Explain step growth polymerization with example. By which polymer processing techniques computer key board could be produced? Write about the technique in brief.
7. Name the different metal or ceramic processing operations present. Cu has atomic radious 0.128nm, FCC cubic crystal, atomic weight: 63.5g/mol, ρ_{cu} =? Show cation to anion ratio for co-ordination number 3 is: 0.155. 4+3+3
8. Write a short note on different surface properties of biomaterials?
9. All rubber, plastic and fiber are polymers-what are their major differences? What do you mean by chromospheres and how they could be detected experimentally? What are the different types of defects of crystal structure is present in metal. What is MIR and write a short note on it? 3+2+2+(1+2)
10. Write a short note on 'Fatigue of materials'. Find the temperature range in which a material (Tm: 350°C) can be used without any danger of creep deformation. Differentiate between reinforcing and non-reinforcing filler with example. How crystalinity of PVC can be reduced?
11. Write the sampling technique for different types of materials for FTIR. What do you mean by finger print region? For a new material what information one can have from FTIR analysis? 6+2+2
12. What do you mean by RIM? What are its advantages? Which type of polymer could be manufactured using this technique? Write in detail how a hollow object could be manufactured.