CBCS SCHEME

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17ME32

Third Semester B.E. Degree Examination, Aug./Sept.2020
Material Science

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define APF. Calculate APF for HCP cell. **(07 Marks)**

b. Explain different types of surface imperfections, with sketch. **(07 Marks)**

c. Explain briefly the mechanical properties of a material in plastic range. **(06 Marks)**

OR

2 a. With sketch, explain cup and cone fracture. **(07 Marks)**

b. With sketch, discuss the different types of stress cycles which bring about fatigue fracture **(07 Marks)**

c. With SN diagram, explain fatigue behavior of different materials. **(06 Marks)**

Module-2

3 a. Explain different types of solid solutions, with sketches. **(06 Marks)**

b. Explain Hume Rothery rules for formation of solid solution. **(05 Marks)**

c. Two metals A and B have their melting points at 900^0C and 800^0C respectively. The alloy pair forms a eutectic at 600^0C of composition 60% B and 40% A. A and B have unlimited mutual liquid solubilities. Their solid solutions are as follows :
10% B in A at 600^0C and 5% B in A at 0^0C. ; 8% A in B at 600^0C and 4% A in B at 0^0C. Assume liquidus , Solidus and Slovns lines to be straight. No solid state reactions or any intermediary phase changes occur in the series.

i) Draw the phase diagram for the series and label all salient temperatures, composition and regions.

ii) Find the room temperature structure of an alloy of composition 60% A and 40% B with respect to the number, type, extent and composition of the phases. **(09 Marks)**

OR

4 a. Draw Fe – Fe_3 C diagram. Label all phases, temperatures. Explain solidification process for any one alloy. **(12 Marks)**

b. Briefly explain three invariant reactions occur in the Fe – C phase diagram at different temperature and carbon concentration. **(08 Marks)**

Module-3

5 a. Draw T – T – T diagram for eutectoid steel and explain. **(08 Marks)**

b. Distinguish between Austempering and Martempering. **(06 Marks)**

c. Differentiate clearly between Normalising and Annealing. **(06 Marks)**

OR

6 a. With sketch, explain Jominy end quench test. **(07 Marks)**

b. Explain composition, properties and uses of gray cast iron and white cast iron. **(07 Marks)**

c. What is age hardening of Aℓ - Cu alloys? **(06 Marks)**

Module-4

7 a. Write a note on Injection Moulding process. **(07 Marks)**
b. What are Ceramics? Briefly explain the types of ceramics. **(07 Marks)**
c. Define Smart materials and explain biological applications of SMA. **(06 Marks)**

OR

8 a. How polymers are classified? What are the characteristics of polymers? **(07 Marks)**
b. Classify ceramic materials. Explain processing method of any one class. **(07 Marks)**
c. Explain Shape memory alloys and their applications. **(06 Marks)**

Module-5

9 a. Classify the composite based on matrix and reinforcement. List the roles of matrix , reinforcement and interface. **(07 Marks)**
b. With flow chart, explain the product of carbon fibres. **(07 Marks)**
c. Explain Resin Transfer Moulding process with sketch. **(06 Marks)**

OR

10 a. List the advantages and applications of composite material. **(07 Marks)**
b. Compare MMC and PMC. **(07 Marks)**
c. A composite material is made by using 10% by volume of Kevlar fibre and 90% epoxy matrix. If elastic modulus of Kevlar is 130 GN/m^2 and epoxy is $4GN/m^2$, calculate the
i) Young's modulus of the composite material in the fibre direction.
ii) Young's modulus of the composite material in the transverse direction. **(06 Marks)**

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