

TME-301

1079

Odd Semester Examination 2018-19

B. TECH (ME) (SEMESTER-III)

MATERIAL SCIENCE

Time: 03:00 Hours

Max Marks :100

Note: Attempt ALL the questions. Marks are shown against each question. Assume any missing data suitably.

1. Attempt any FOUR of the following : (5x4=20 Marks)
- (a) The atomic weight of copper is 63.55, meaning that 6.023×10^{23} atoms weigh 63.55 grams. The density of copper is 8970 kg/m^3 , and pure copper forms FCC crystals. Estimate the diameter of a copper atom.
 - (b) Copper has an atomic radius of 0.128 nm, an FCC crystal structure, and an atomic weight of 63.5 g/mol. Compute its theoretical density.
 - (c) Derive planar density expressions for FCC (100) and (111) planes in terms of the atomic radius R.
 - (d) What are the different types of imperfection? Explain any two.
 - (e) What is diffusion? Explain steady state diffusion.
 - (f) Explain the different types of dislocations.
2. Attempt any FOUR of the following : (5x4=20 Marks)
- (a) A piece of copper originally 305 mm long is pulled in tension with a stress of 276 MPa. If the deformation is entirely elastic, what will be the resultant elongation?

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- (b) What is ductility, and how is it measured? Also explain creep.
- (c) What testing procedures can be used to measure the properties of brittle materials, such as ceramics and carbides?
- (d) Explain high and low cycle fatigue. Also explain fatigue life.
- (e) What is Knoop and Vickers hardness?
- (f) What is the difference between the microstructure of ductile and brittle material?

3. Attempt **any TWO** of the following : (10x2=20 Marks)

- (a) What is a solid solution? Describe the difference between a solute and a solvent. What are the conditions for obtaining (a) Substitutional and (b) Interstitial solid solutions?
- (b) What is Heat Treatment? Explain any two heat treatment processes and how they are affecting the microstructure of metals?
- (c) What are the major categories of ferrous alloys? What are the major alloying elements in tool and die steels and in high-speed steels? What are the applications of advanced high-strength steels?

4. Attempt **any TWO** of the following : (10x2=20 Marks)

- (a) Explain the concept of magnetism. What are the different types of magnets? Explain.
- (b) Compute the electrical conductivity of a 7.0-mm diameter cylindrical silicon specimen 57 mm long in which a current of 0.25 A passes in an axial direction. A voltage of 24 V is measured across two probes that are separated by 45 mm. Also Compute the resistance over the entire 57 mm of the specimen.
- (c) Briefly explain why thermal stresses may be introduced into a structure by rapid heating or cooling. For cooling, what is the nature of the surface stresses? For heating, what is the nature of the surface stresses?

5. Write short notes on any **FOUR** of the following : (5x4=20 Marks)
- (a) Explain why residual thermal stresses are introduced into a glass piece when it is cooled?
 - (b) What is the distinction between glass transition temperature and melting temperature?
 - (c) For thermoplastic polymers, cite five factors that favour brittle fracture.
 - (d) Explain injection moulding with neat sketch.
 - (e) Cite five important characteristics for polymers that are to be used in thin-film applications.
 - (f) What is thermoset plastic? Explain any two thermoset plastics.

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