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Third Semester B.E. Degree Examination, June/July 2023 Material Science and Metallurgy

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. With a neat sketch, explain the BCC structure and derive an expression for Atomic Packing Factor (APF) for BCC structure. (10 Marks)
- b. What is diffusion? Explain the various diffusion mechanisms. (10 Marks)

OR

- 2 a. Compare and contrast edge dislocation and screw dislocation. (10 Marks)
- b. Nitrogen from a gaseous phase is to be diffused into pure iron at 700°C. If the surface concentration is maintained at 0.1 wt % N, what will be the concentration 1mm from the surface after 10hrs? The diffusion co-efficient for Nitrogen in iron at 700°C is $2.5 \times 10^{-11} \text{ m}^2/\text{s}$. (10 Marks)

Module-2

- 3 a. Explain the construction of Mohr's circle and represent principal stress. (08 Marks)
- b. Determine : i) Maximum and minimum normal stresses and locate their planes
ii) Maximum shear stress and specify its plane.

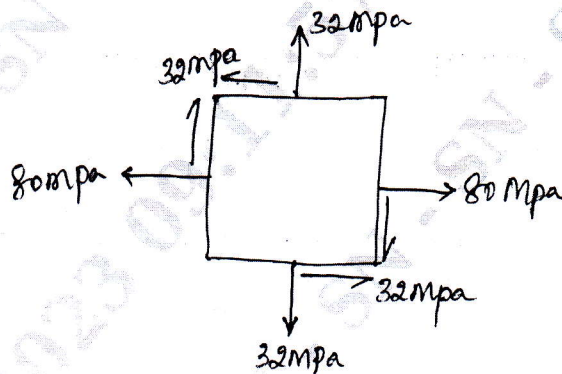


Fig Q3(b)

(12 Marks)

OR

- 4 a. Define fracture. Explain Cup and Cone fracture with a neat diagram. (10 Marks)
- b. Define Creep. Explain Creep curve with a neat diagram. (10 Marks)

Module-3

- 5 a. Illustrate the different types of batteries with suitable examples. (10 Marks)
- b. Write a short note on electrolytes and electrode in batteries. (10 Marks)

OR

- 6 a. What are fuel cells? Explain the principle of working of fuel cells with suitable sketches. (10 Marks)
- b. Illustrate the principles of electro chemical super capacitors. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

- 7 a. Illustrate the classification of heat treatment and list the purpose of heat treatment. (10 Marks)
b. Write a short note on :
i) Tempering
ii) Nitriding
iii) Flame hardening. (10 Marks)

OR

- 8 a. Describe the properties and applications of different grades of stainless steels. (10 Marks)
b. Write a short note on malleable cast iron with suitable micro structure. (10 Marks)

Module-5

- 9 a. Explain any two types of bronze alloys. (10 Marks)
b. Illustrate the phase diagram of Aluminium – copper (Al – Cu) alloy and list the applications, advantages and disadvantages. (10 Marks)

OR

- 10 a. With a neat sketch, explain the vacuum bagging process of FRP composites. (10 Marks)
b. What are metal matrix composites? Explain the advantages, disadvantages and applications. (10 Marks)

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