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Third Semester B.E. Degree Examination, Aug./Sept. 2020 Materials 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. Define Engineering stress and strain. Derive a relationship between True strain and engineering strain. (10 Marks)
- b. Name the type of the structure and sketch the unit cell of the following metals: Iron, Copper, Aluminum and magnesium. (10 Marks)

OR

- 2 a. What do you mean by linear and non-linear properties of materials? Explain in brief any two properties. (08 Marks)
- b. Write a note on crystal imperfections. Explain in detail about line defects. (08 Marks)
- c. Zinc has HCP structure. The height of the unit cell 0.494nm, the nearest neighbor is at a distance of 0.27nm. Calculate the volume of unit cell of zinc. (04 Marks)

Module-2

- 3 a. Distinguish between brittle and ductile fracture with graphical representation. (08 Marks)
- b. What do you understand by stress relaxation and elaborate with examples. (06 Marks)
- c. Draw and explain S-N curve for steel and Aluminium alloy. (06 Marks)

OR

- 4 a. Explain the creep behavior of mildsteel with the help of a three stage creep curve. (10 Marks)
- b. Discuss the effects of
- Surface Roughness
 - Stress Concentration on fatigue strength of metals. (10 Marks)

Module-3

- 5 a. Define Solid Solution with the aid of sketches, the various types of solid solution which may be formed in metallic alloys. (08 Marks)
- b. How do solid solutions differ from intermetallic compound? (04 Marks)
- c. Explain Hume-Rothery rules as applied to the formation of substitutional solid solutions. (08 Marks)

OR

- 6 a. Illustrate the effects alloying on the eutectoid temperature of steels. (04 Marks)
- b. Draw the iron-Carbon diagrams and labell all the parts. (08 Marks)
- c. What is invariant reactions? Write down the following invariant reactions
- Eutectic system
 - Peritectic system. (08 Marks)

Module-4

- 7 a. Explain the various Annealing process and their purpose. (10 Marks)
- b. Discuss nitriding as a method of surface hardening of steel and compare it with induction hardening. (10 Marks)

OR

- 8 a. Briefly describe effect of chemical composition and properties of
i) Malleable iron (06 Marks)
ii) Nodular iron. (06 Marks)
- b. Explain case Carburization of surface heat treatment. (06 Marks)
- c. Show schematically, the microstructure of the following, Gray cast iron and white cast iron and its properties, composition and applications. (08 Marks)

Module-5

- 9 a. Write a short note on copper alloys. (06 Marks)
- b. Explain the modification of Al-Si alloy. (06 Marks)
- c. Discuss the composition, properties and types of α -Brasses and bronze. (08 Marks)

OR

- 10 a. What is Composite Materials? How it is classified? (04 Marks)
- b. With a neat sketch, explain any one method of production of fiber reinforced plastic (polymer). (08 Marks)
- c. Briefly discuss the advantages and applications of composites of materials. (08 Marks)
