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**S.E. Mechanical (Sem-III) (Revised Course 2016-2017)**
**EXAMINATION NOV/DEC 2019**
**Engineering Materials Science and Metallurgy**

**[Duration : Three Hours]** **[Total Marks : 100]**

**Instructions:**
1) Read the question paper carefully.
2) Sketches are very important. Draw neat sketches wherever required.
3) Assume suitable data if required.

## PART - A

**Answer any two questions from the following.**

**Q.1** a) Describe the crystal structures found in most of the common metals. **(6)**

b) Explain ductile fracture and brittle fracture. What is ductile to brittle transition? **(6)**

c) Discuss cooling curves and how they are used to draw phase diagrams. **(8)**

**Q.2** a) Describe and illustrate edge and screw dislocations. **(7)**

b) Derive an expression for the energy of a screw dislocation. **(7)**

c) Draw the stress – strain diagram for mild steel obtained in a tensile test. Explain the salient features of the diagram. **(6)**

**Q.3** a) What is strain hardening? Discuss the processes recovery, recrystallization and grain growth during annealing of a cold worked metal. **(6)**

b) Draw the iron – carbon equilibrium diagram showing all the phases. Write briefly about these phases. **(7)**

c) Explain the process of formation of the eutectic at the eutectic temperature when the molten alloy of eutectic composition is cooled. **(7)**

## PART-B

**Answer any two questions from the following.**

**Q.4** a) What is the purpose of case hardening? Explain the different methods of case hardening. **(7)**

b) Discuss the preparation of specimens for microscopical examination in metallography. **(7)**

c) What is precipitation hardening? Explain with sketches. **(6)**

**Q.5** a) What is powder metallurgy? List out the various stages of powder metallurgy. Explain any two stages in detail. **(7)**

b) Write a note on normalizing in steels. **(7)**

c) Compare and contrast flame hardening with induction hardening. **(6)**

**Q.6** a) What are alloy steels? What is the purpose of alloying steels? List the effect of common alloying elements and the application of these steels. **(7)**

b) What is non - destructive testing? Why is it important? Explain any two non- destructive tests in detail. **(6)**

c) Write a note on annealing in steels. **(7)**

## PART-C

**Answer <u>any one</u> questions from the following.**

**Q.7** a) What is fatigue? Write a note on fatigue testing of metals. **(6)**

b) Write a note on ceramic materials. **(7)**

c) Write a note on tool steels **(7)**

**Q.8** a) Draw and explain time – temperature – transformation (TTT) curves for a plain carbon steel of eutectoid composition. Explain the effect of different cooling rates on the microstructure. **(8)**

b) Write a note on composite materials. **(6)**

c) Write a note on cast irons. **(6)**