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[5559]-113

**S.E. (Mechanical/Auto.) (First Semester) EXAMINATION, 2019**  
**MATERIAL SCIENCE**  
**(2015 PATTERN)**

**Time : 2 Hours**

**Maximum Marks : 50**

- N.B. :—** (i) Answer *four* question : Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
- (ii) Neat diagrams should must be drawn wherever necessary.
- (iii) Use of non-programmable electronic pocket calculator is allowed.
- (iv) Figures to the right indicate full marks.

- Q.1 a) Classify and describe different types of polymers on the basis of molecular structure and comment on their mechanical properties [5]
- b) Compare metals, ceramics and polymers on the basis of atomic bonding, atomic arrangement and properties. [5]
- c) Explain in brief with neat sketch line defects in crystal structures. [3]
- OR**
- Q.2 a) What is work hardening? Explain single crystal and dislocation theory of work hardening. [5]
- b) Derive an expression for resolved shear stress across slip plane in a single crystal subjected to tensile load(P). Slip plane is oriented at an angle of " $\phi$ " between normal to slip plane and direction of loading and angle of " $\lambda$ " between direction of loading and slip plane in the slip direction. State Schmid's law. [5]
- c) Calculate planar atomic density of (100) plane in FCC, assume lattice parameter as 'a'. Also calculate linear atomic density of [011] direction in this plane. [3]
- Q.3 a) State working principle and operational steps of dye penetrant test for detection of surface cracks. [4]
- b) Differentiate between true stress-strain and engineering stress-strain. [4]
- c) Explain the mechanism of dry corrosion and factors affecting dry corrosion. [4]
- OR**
- Q.4 a) State various methods of prevention of corrosion and explain any one in detail. [4]
- b) State true or false and justify your answer. (Full marks for correct justification only) [4]
- i) Pitting is the most dangerous form of corrosion.
- ii) In anodic protection method for corrosion metal to be protected is forced to behave as cathode.
- c) What is fatigue? Draw S-N diagram for ferrous and nonferrous materials. Define the term fatigue limit and fatigue strength. [4]

P.T.O.

- Q.5 a) Explain the principle and working of electroplating with neat diagram. Which factors affect the quality of coating in electroplating? [5]  
 b) Why surface preparation is essential before coating? List various methods of surface preparation and explain any one in detail. [5]  
 c) Explain in brief different defects observed in coatings. [3]
- OR**
- Q.6 a) How surface modification methods are classified? List at least any two methods in each category and explain any one in brief. [5]  
 b) Explain with neat diagram PVD process of coating and state its advantages, limitations and applications. [5]  
 c) Explain in brief with neat diagram Ion implantation. [3]
- Q.7 a) Explain the need and mechanism of sintering in powder metallurgy component. What is liquid phase sintering? [4]  
 b) State various mechanical methods of powder manufacturing and explain in brief atomization. [4]  
 c) Explain with neat flow chart manufacturing of self-lubricated bearings. [4]
- OR**
- Q.8 a) What do you understand by powder characterization? Explain in brief any two methods of particle size measurement. [4]  
 b) Explain with neat flow chart manufacturing of cemented carbide tools. [4]  
 c) State the advantages, limitations and applications of powder metallurgy. [4]