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[5668]-114

S.E. (Mechanical/Automobile) (First Semester) EXAMINATION, 2019

MATERIAL SCIENCE

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :— (i) Solve 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) Figures to the right indicate full marks.
(iii) Draw the neat sketch wherever necessary.

1. (a) Draw Lattice planes for the following Miller indices : [4]
(1) $(2 \ 3 \ 1)$
(2) $(1 \ 1 \ 0)$
- (b) Differentiate between BCC and FCC structure on the basis of the following : [4]
(1) Atomic packing factor
(2) Average no. of atoms per unit cell
(3) Relation between radius of atom and lattice parameter.
(4) Example of Material
- (c) What do you mean by the term “imperfections in crystal structure ? [4]

P.T.O.

Or

2. (a) Differentiate between slip and twinning on the basis of the following parameters : [4]
- (1) sketch
 - (2) definition
 - (3) required stress to produce slip/twinning
 - (4) direction of the slip/twinning
- (b) Discuss the Dislocation theory of work hardening with neat sketch. [4]
- (c) Define “volume density” of a metal. Calculate the X ray density of aluminum. Given : Lattice constant : 4.049\AA , atomic weight 26.98 gm/mole and Avogadro's number = 6.02×10^{23} atoms/mole. [4]
3. (a) Identify the type of mechanical testing for the following (any five) : [5]
- (i) Determination of strength, resilience, toughness etc. of material.
 - (ii) Susceptibility of materials for brittle failures under the existence of stress, temperature, strain rate etc.
 - (iii) Failure of material at a stress level far below its ultimate tensile strength when acted upon by frequent stress fluctuations.
 - (iv) The slow and progressive deformation of a material with time under a constant stress and high temperature.

- (v) Material inspection for detecting internal defects such as cracks, porosity and laminations in metallic and non-metallic components during or after production.
- (vi) Inspection of many components at the same time.
- (b) Explain “Ultrasonic inspection method” with neat sketch, advantages and disadvantages. [4]
- (c) Explain any four corrosion prevention and control methods. [4]

Or

4. (a) Explain the reason for the following types of corrosion (any five) : [5]
- (1) Pitting corrosion
 - (2) Stress corrosion
 - (3) Cavitation corrosion
 - (4) Intergranular corrosion
 - (5) Crevice corrosion
 - (6) Galvanic corrosion
 - (7) Caustic embrittlement
- (b) What do you mean by the term “Fatigue in material” ? List out various methods to increasing the fatigue life ? [4]
- (c) What are the various points should be considered before selecting the materials for a particular service environment. [4]

5. (a) Explain with neat sketch, advantages and disadvantages the Ion Implantation method of surface modification. [5]
- (b) Describe the following terms with neat sketches (any two) :
- (1) Shot Blasting
 - (2) Plasma nitriding
 - (3) Anodizing [4]
- (c) Explain with neat sketch the process of electroplating ? List out the various factors which affect the electroplating. [4]
- Or
6. (a) Explain with neat sketch, advantages and disadvantages the Ion vapor deposition method of surface modification. [5]
- (b) Draw self-explanatory figure of Physical vapor deposition and chemical vapor deposition of method of surface modification. [4]
- (c) List out any four coatings defects with its probable causes. [4]
7. (a) Define the term 'powder metallurgy' with basic steps and applications. [4]
- (b) Explain any two powder manufacturing processes for the following types : [4]
- (1) Mechanical processes.
 - (2) Chemical processes.

(c) Explain the role of powder metallurgy for manufacturing of 'cemented carbide' with neat flow chart ? [4]

Or

8. (a) Explain the types of methods for measurement of powder size and distribution in powder metallurgy. [4]
- (b) What are the various compacting or pressing properties of powder in powder metallurgy ? [4]
- (c) What is a 'self-lubricated bearing' ? Explain the role of powder metallurgy for manufacturing of 'self-lubricated bearings' ? [4]