

Total No. of Questions—8]

[Total No. of Printed Pages—5

Seat No.	
-------------	--

**[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)  $(2 \ 2 \ 1)$   
(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 :  $4.049 \text{ \AA}$ , atomic weight  $26.98 \text{ gm/mole}$  and Avogadro's number =  $6.02 \times 10^{23}$  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]