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**[4957]-1013****S.E. (Mechanical/Automobile) (First Semester)****EXAMINATION, 2016****MATERIAL SCIENCE****(2012 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) What do you mean by space lattice ? Write any *three* imperfections in crystals/lattices with example of each. [4]  
(b) What is plastic deformation in materials ? Differentiate between slip and twinning. [4]  
(c) What do you mean by isostress and isostrain condition in composite materials ? Calculate the composite modulus for polyester reinforced with 60 volume % E-glass under isostrain conditions. (Take Young modulus for polyester 6.9GPa and for glass it is 72.4GPa). [4]

*Or*

2. (a) What do you mean by the term 'Polymer' ? Differentiate between Thermoplastic and Thermosetting polymers. [4]  
(b) What do you mean by Composite Materials ? Explain with its types and classification. [4]

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- (c) What do you mean by "True stress and True Strain in materials"? Derive the relationship between both of it. [4]
3. (a) What is the difference between Hardness and Toughness of the Material ? Explain any *two* testing methods for checking the hardness of the material with their principal of working and mathematical formula for calculation ? [5]
- (b) What is Notch toughness in Impact Test ? List out the factors by which the Impact values of materials get affected. [4]
- (c) What do you mean by 'Non Destructive Testing ? Explain Radiography method of testing with working principal, advantages and applications ? [4]

*Or*

4. (a) Identify the methods of material testing in the following cases : [5]
- (i) To measure hardness of cast components, heterogeneous materials like cast irons and porous powder metallurgy components.
- (ii) To measure the properties like electrical conductivity, magnetic permeability, grain size, heat treatment conditions, hardness and physical dimensions.
- (iii) To test large sized, uniform thickness and one/many components at the same time.
- (iv) In quality control test for detecting internal defects such as cracks, porosity, and laminations in metallic and non-metallic components during or after the production.

- (v) Materials working for a continuous high temperature service under stressed conditions such as jet engine components, gas and steam turbines, nuclear reactors and tungsten filaments for electric bulbs.
- (b) Explain the working principle of fatigue test machine ? What are the different protection methods of fatigue life ? [4]
- (c) What do you mean by the term 'creep fracture' ? What are the requirements for creep resistant materials ? [4]
- 5.** (a) Define the term 'powder metallurgy' ? List out its various applications specifying example for each of them. [5]
- (b) What are the various properties of powder material that should be evaluated in powder metallurgy process ? [4]
- (c) What are the steps involved in the production of a 'refractory materials' using powder metallurgy ? [4]
- Or*
- 6.** (a) Explain the classification of various processes used to manufacture the powder in powder metallurgy process. [5]
- (b) What do you mean by sintering of metal powders ? Explain with purpose and different processing stages ? [4]
- (c) What are the steps involved in the production of a 'diamond impregnated tools' using powder metallurgy ? [4]
- 7.** (a) Explain the following terms (any two) : [4]
- (i) Biomaterials
- (ii) Shape memory alloy
- (iii) Superconductors.
- (b) What do you mean by the term Piezometric materials ? Explain with types. [4]

- (c) Explain the magnetic material ? Differentiate between hard and soft magnetic materials ? [4]

*Or*

8. (a) Explain the following terms (any *two*) : [4]  
(i) Nanomaterials  
(ii) Biosensors  
(iii) Dielectric materials
- (b) Explain the concept of smart materials and its Cryogenic applications. [4]
- (c) Explain 'The Modern materials for high temperature applications '? [4]

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