

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-III(New) EXAMINATION – SUMMER 2016

Subject Code:2131904

Date:02/06/2016

Subject Name:Material Science and Metallurgy

Time:10:30 AM to 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS

Q.1

Short Questions

14

- 1 Which one of the following is not basic component of Materials science? _____.
(a) Cost (b) Properties (c) Structure (d) Performance
- 2 Strong and ductile materials
(a) Polymers (b) Ceramics (c) Metals (d) Semiconductors
- 3 An eutectoid steel consists of _____.
(a) Wholly Pearlite (b) wholly austenite (c) pearlite and ferrite
(d) pearlite and cementite
- 4 The hardness and tensile strength in austenitic stainless steel can be increased by _____.
(a) hardening and cold working (b) normalising (c) martempering
(d) full annealing
- 5 Iron-carbon alloys containing 1.7 to 4.3% carbon are known as _____.
(a) eutectic cast irons (b) hypo-eutectic cast irons (c) hyper-eutectic cast irons (d) none of these
- 6 The heat treatment process used for softening hardened steel is _____.
(a) carburising (b) normalising (c) annealing (d) tempering.
- 7 The type of space lattice found in gamma-iron is _____.
(a) FCC (b) BCC (c) HCP (d) none of these
- 8 Which of the following is a point imperfection? _____.
(a) Vacancy (b) Interstitial imperfection (c) Frenkel imperfection
(d) all of these
- 9 Micro-structure of a material is, generally, examined by _____.
(a) naked eye (b) optical microscope (c) X-ray techniques (d) none of these
- 10 In a unit cell of a body centred cubic space lattice, there are _____ number of effective atoms.
(a) 2 (b) 9 (c) 1 (d) 4
- 11 Silicon is added in low carbon steels to _____.
(a) Make the steel tougher and harder (b) make the steel of good bending qualities (c) raise the yield point (d) all of these.
- 12 The compressive strength of Cast Iron is _____ that of its Tensile strength.
(a) Equal to (b) less than (c) more than

- 13 The ratio of the volume occupied by the atoms to the total volume of the unit cell is called _____
(a) Coordination number (b) atomic packing factor (c) space lattice (d) none of these.
- 14 Wrought iron _____
(a) is a ductile material (b) can be easily forged or welded (c) cannot stand sudden and excessive shocks (d) all of these.
- Q.2 (a) Classify the engineering materials. Explain any two of them. 03
(b) Differentiate between Edge and Screw dislocation. 04
(c) Explain in detail, the solidification of an ingot/casting giving sketches of all important zones produced as a structure of ingot/casting. 07
- OR
- (c) What is twinning deformation? Explain the difference between slip and twinning mechanisms using sketch. 07
- Q.3 (a) Explain the phenomenon of “Allotropy” by giving a suitable example. 03
(b) Draw a unit cell and show the following planes (a) (113) (b) (102) (c) (111) and (d) (001). 04
(c) Differentiate between Micro and Macro examination of engineering metallic materials? Completely describe the procedure for “specimen preparation for microscopic examination”. 07
- OR
- Q.3 (a) State the “Gibbs phase rule”. Using this rule prove that degree of freedom at eutectic point in a binary phase diagram is zero. 03
(b) What is the metallurgical explanation of effects of chromium, nickel, molybdenum, and carbon in stainless steels? 04
(c) Differentiate between Homogeneous and Heterogeneous nucleation processes. Also discuss the conditions under which growth may be of planar and dendritic type. 07
- Q.4 (a) Draw the microstructure of white cast iron and enlist its properties. 03
(b) Enlist methods of manufacturing metal powder. Describe any one in detail. 04
(c) Evaluate: Annealing is never a final heat treatment process for hypereutectoid steel. Compare and contrast the Annealing with Normalizing process. 07
- OR
- Q.4 (a) State critical reactions of Iron Carbon phase diagram. 03
(b) What is Alloying? Explain the effects of chromium as an alloying element. 04
(c) Justify the need of Heat treatment processes for metals. Explain with neat sketch TTT diagram for heat treatment of steel. 07
- Q.5 (a) List various nondestructive tests. Explain general advantages and disadvantages of non-destructive tests. 03
(b) Explain the phenomenon of “Coring”. 04
(c) Define Powder Metallurgy. State advantages, limitations and applications of Powder Metallurgy. 07
- OR
- Q.5 (a) Explain following alloys giving their important constituents & Applications : (I) Monel (II) Invar (III) Nichrome. 03
(b) Completely describe the “Sintering Process”. 04
(c) Explain the Eddy current Method of Testing with neat sketch. Also explain its benefits and limitations. 07
