

Form A:

Ref. No. Ex/PROD/PC/B/T/221/2022

B.E. PRODUCTION ENGINEERING SECOND YEAR SECOND SEMESTER - 2022

SUBJECT: MATERIALS SCIENCE AND TECHNOLOGY

Time : Three hours

Full Marks : 100

**ANSWER QUESTION NO. 1 AND
ANY FOUR QUESTIONS FROM THE REST**

*(Answer briefly. Irrelevant discussion will be penalised.
Draw the sketches neatly and label them properly)*

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|-------|---|----|
| 1. a) | Draw the iron-carbon equilibrium diagram and properly label the phase name, temperature, percentage of carbon, eutectic, eutectoid, peritectic point, hyper and hypo eutectic and eutectoid zone, commercial cast iron and different steel range etc. | 13 |
| b) | Draw and label the T-T-T diagram for carbon steel with 0.8% carbon form kinetic curve. | 5 |
| c) | Explain briefly the sintering process with suitable figure/s. | 4 |
| d) | Describe briefly Creep of the metal. | 4 |
| e) | What do you mean by tripple point? Explain with help of Gibb's Phase rule. | 2 |
| f) | Differentiate between Austempering and Martempering of carbon steel. | 4 |
| g) | Write short notes on: Nitrides Ceramics | 4 |
| 2. a) | Describe relation between bonding forces and bonding energy with inter-atomic separation. | 5 |
| b) | Draw a $[\bar{6} 9 0]$ direction in a base centered orthorhombic lattice. | 3 |
| c) | X-rays with a wavelength of 1.54 Å are used to calculate the spacing of (200) planes in aluminium. The Bragg angle for this reflection is 22.4°. What is the size of the unit cell of the aluminium crystal? | 4 |
| d) | Compare FCC and BCC crystal structure. | 4 |
| 3. a) | Describe strain hardening phenomenon. | 4 |
| b) | Explain briefly Anelasticity, Fatigue Failure, Malleability and Resilience. | 7 |
| c) | Compare Planar Growth and Dendritic Growth during solidification of materials with suitable diagram. | 5 |

P.T.O.

[Turn over

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4. a) Explain the mechanism of ingot structure formation during solidification with suitable sketches. 6
- b) What is hardenability? 2
- c) Describe the Correlation of hardenability and continuous cooling phenomenon for an iron-carbon alloy of eutectoid composition from end-quench hardenability test (Jominy end-quench test). 8
5. a) Differentiate between Normalising and Full Annealing of carbon steel with suitable diagram. 5
- b) Write short notes on: 3+4+4
- (i) Stainless Steel,
- (ii) Nodular Cast Iron.
- (iii) Wrought Iron
6. a) Explain with proper diagram the principles of an Ultrasonic testing procedure for detecting a fault in the lower surface of a plate. 6
- b) Write short notes on: 3+4+3
- (i) Inconel;
- (ii) Shape Memory Alloy.
- (iii) Babbitt Metal
7. a) Write short notes on: 3×4
- (i) Glass Fibers
- (ii) Matrix Materials in reinforced plastics
- (iii) Ceramics-matrix composites (CMC)
- b) Differentiate between thermoplasts and thermoset polymer. 4