

**B.E. PRODUCTION ENGINEERING SECOND YEAR SECOND SEMESTER – 2023**

**MATERIALS SCIENCE AND TECNOLOGY**

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. | 14 |
| b)    | Draw and label the T-T-T diagram for carbon steel with 0.8% carbon form kinetic curve.  | 5  |
| c)    | Explain briefly heterogeneous nucleation.   | 4  |
| d)    | Explain briefly the sintering process with suitable figure/s.   | 4  |
| e)    | Explain different types of liquid penetration test for Non-Destructive Testing of materials.  | 6  |
| f)    | Briefly describe the general characteristics and common uses of MMC   | 3  |
| g)    | Differentiate between thermoset and thermoplast polymers.   | 4  |
| 2. a) | Describe relation between bonding forces and bonding energy with interatomic separation.  | 5  |
| b)    | Draw a $[\bar{6} 3 0]$ direction in a base centered orthorhombic lattice.   | 3  |
| c)    | The interplaner spacing between $(\bar{2} 0 1)$ planes in a lithium crystal is $0.68\text{\AA}$ . Determine the lattice parameter and the atomic diameter.  | 4  |
| d)    | Write Shot note on FCC crystal structure.   | 3  |
| 3. a) | Briefly describe edge dislocation.  | 2  |
| b)    | Explain briefly Anelasticity, Fatigue Failure, Malleability and Resilience.   | 8  |
| c)    | Discuss briefly Creep phenomenon of the metal.  | 5  |

[ Turn over

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4. a) Compare Planar Growth and Dendritic Growth during solidification of materials with suitable diagram. **5**
- b) Explain the mechanism of ingot structure formation during solidification with suitable sketches. **6**
- c) What is eutectic point? Explain with the help of ice-sodium chloride phase equilibrium diagram. **4**
5. a) Explain briefly the Nitriding process with its merits and demerits. **6**
- b) Differentiate between Normalising and Full Annealing of carbon steel with suitable diagram. **6**
- c) Write short notes on: Stainless Steel, **3**
6. a) Describe the merits and demerits of High Frequency Induction Furnace in Steel Industries. **6**
- b) Write short notes on: **3×3**
- (i) Inconel;
  - (ii) Shape Memory Alloy;
  - (iii) Zirconia.