

B.E. PRODUCTION ENGINEERING 2nd YEAR 2nd Semester EXAMINATION, 2025
SUBJECT: MATERIAL SCIENCE AND TECHNOLOGY

Time: Three hours

Full Marks 100

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

1. a) Draw a $(4 \times 8 \times 6)$ plain in a body centered tetragonal or Face centered Orthorhombic lattice 3
- b) Discuss about the different types of point imperfections with suitable sketches. 5
- c) Describe briefly Metallic bonding with suitable figure. 2
- d) X-rays with a wavelength of $1.54 \text{ \AA}$ 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
- e) State Fick's first and second law of diffusion and explain the different mechanisms of diffusion 6
(CO1)

2. a) Describe briefly about the Fatigue failure and failure due to Creep of the material. 3+5
- b) Explain proportional limit, yield strength, ultimate tensile strength and fracture point with the help of stress-strain diagram. 3
- c) Describe strain hardening phenomenon with suitable figure. 4
- d) Explain the Magnetic methods for detecting different discontinuities in the material. 5
- OR**
- Describe the Ultrasonic Non-Destructive Testing of materials. (CO2)

3. a) Differentiate between Homogeneous and Heterogeneous nucleation 5
OR
Differentiate between Planar growth and Dendritic growth.
- b) Explain eutectic point with the help of ice-sodium chloride phase equilibrium diagram. 2
- c) 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
(CO3)

4. a) Draw and label the T-T-T diagram for carbon steel with 0.8% carbon from kinetic curve. 5

[Turn over

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| b) | Differentiate between Austempering and Martempering of carbon steel. | 5 |
| c) | Explain the nitriding process. | 5 |
| | OR | |
| | Discuss briefly the Full annealing process. | |
| d) | Describe briefly LD process OR Direct Arc furnace steel making process. | 5 |
| | (CO4) | |
| 5. a) | Write short notes on: (any one) | 3 |
| | I. Gun Metal; | |
| | II. PMMA | |
| b) | Briefly discuss about characteristics and uses of Alumina | 4 |
| c) | Describe briefly three different biodegradable plastics with their uses. | 6 |
| d) | Explain briefly the sintering process with suitable figure/s. | 3 |
| e) | Write short notes on(any one): | 4 |
| | (i) Stainless Steel. | |
| | (ii) MMC | |
| | (CO5) | |