

**B.E. MET. AND MAT. ENGG. THIRD YEAR SECOND SEMESTER EXAM 2019****SUBJECT: SOLID STATE PHASE TRANSFORMATION PROCESSES****Time: 3 hours****Full Marks: 100**

**Answer any four (4) questions. Answers must be brief and to the point. All parts of the same question must be answered contiguously.**

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| 1 | (a) What are the different methods of determination of hardenability? What is critical diameter? Compare and contrast: Grossman's critical diameter method and Jominy end quench test       | 4+2+<br>10 |
|   | (b) Is it possible to define hardenability of cast iron? Explain.   | 5          |
|   | (c) Why does increase in carbon in plain carbon steel enhances its hardenability?   | 4          |
| 2 | (a) What is the normalising temperature of the hypereutectoid steel? Justify.   | 5          |
|   | (b) Do you recommend carburising treatment to a steel containing 0.3 wt% carbon? Justify. Why does nitriding offer higher hardness than carburising treatment of a steel?                   | 5+5        |
|   | (c) Discuss the role of permeability in induction hardening.  | 6          |
|   | (d) Do you recommend tempering after nitriding?   | 4          |
| 3 | (a) Discuss the microstructure changes that take place during tempering of a steel containing 0.4 wt% carbon.   | 8          |
|   | (b) A steel containing 0.2 wt% Carbon and 4 wt% Molybdenum exhibits tempered martensite embrittlement. Why?   | 6          |
|   | (c) What is Holloman-Jaffe parameter? What are the uses of Holloman-Jaffe parameter?  | 5+6        |
| 4 | (a) With the increase in Chromium content in steels containing 0.3 wt % carbon exhibits higher hardness after tempering. Why? Why does tempering lead to enhancement of ductility in steel? | 7+6        |
|   | (b) Discuss the eutectoid transformation in 0.4 wt% plain carbon steel. What are the roles of prior austenite grain structure in the kinetics of eutectoid transformation?                  | 7+5        |

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| 5 | (a) Why does quench cracks develop in steel? What is austenite stabilisation?<br>Differentiate: Martempering and austempering  | 6+5+<br>6 |
|   | (b) Discuss the lattice correspondence for the formation of martensite from austenite.   | 8         |
| 6 | (a) Describe the roles of carbon and silicon in bainitic transformation? Why does bainitic microstructure exhibit an excellent combination of strength and toughness?  | 9+5       |
|   | (b) Do you recommend the use of bainitic steel in power generation industries? Justify. With the increase in the amount of retained austenite the scatter in the toughness of the bainitic steels increases. Substantiate. | 5+6       |