

MANIPAL INSTITUTE OF TECHNOLOGY

Reg.No.

Manipal University, Manipal - 576 104

III SEMESTER B.TECH (MECHATRONICS ENGG.) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2015 SUBJECT: MATERIAL SCIENCE AND ENGINEERING (MTE 2101)

Time: 3 Hours.

Instructions to Candidates:

- ✤ Answer ALL the Questions.
- ✤ Missing data, if any, may be suitably assumed.
- Draw neat labeled diagrams wherever necessary.
- Show the calculations of Atomic Packing Factor for the relevant crystal structures 1A. (05)occurring in α -Fe (ferrite) and γ -Fe (Austenite).
- Calculate the amount of Pro-eutectic ferrite, Pearlite, total Ferrite for 0.4%C steel at **1B.** (03)eutectoid temperature in the Iron Cementite diagram.
- 1C. Enumerate the factors affecting the induction heat treatment process (02)
- 2A. Discuss dendritic and planar growth of crystals showing how latent heat is removed. (04)
- **2B**. Melting temperatures of Metals A and B are 1080 degree centigrade and 960 degree (06) centigrade respectively. The metals A and B are mutually soluble in the liquid state and partly soluble in the solid state. A liquid phase alloy containing 60% B completely transforms into a mixture of two solid solutions at 700 degree centigrade. Maximum solubility of B in A and A in B are 8% and 10% respectively at 700 degree centigrade. The room temperature solubility is negligible. Assuming the curves to be linear, draw phase diagram to scale and label the regions. For 40% B alloy determine the following:
 - a) Composition of the nucleus formed.
 - b) Weight percentage of eutectic formed at 699 degree centigrade.
 - c) Weight percentage of Pro-eutectic solid formed.
- Discuss Iron-Cementite equilibrium diagram and mark the phases. Show how pearlite is 3A. (05)formed from 0.4% C alloy.
- **3B**. Discuss the effect of transverse and lateral loading of fiber reinforced composites. (05)



MAX.MARKS: 50

4A. Represent the following miller indices in simple unit cubic cells.

- i. (110)
- ii. $(\frac{1}{3}\frac{1}{6}\frac{1}{2})$
- iii. [222]
- iv. [164]
- **4B.** Write a note on Aluminum alloys and Copper alloys. (03)
- **4C.** Discuss the significance of Superparamagnetism and ferroelectricity. Give applications for **(03)** each.
- 5A. With the help of TTT diagram show how lower and upper bainite structures are obtained. (04)
- **5B.** Compare between thermoplastics and thermosetting plastics. (03)
- 5C. In Jomny End quench test show how the hardness of the specimen varies with respect to (03) the increase in distance from quenched end.

(04)