Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

III SEMESTER B.TECH. (MECHANICAL / I & P ENGINEERING)

END SEMESTER MAKE UP EXAMINATIONS, DEC 2016/JAN 2017

SUBJECT: MATERIAL SCIENCE AND METALLURGY [MME 2104]

REVISED CREDIT SYSTEM
(06/01/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Explain the following:
(i) Gibb's Phase rule (ii) Lever rule **4**

1B. Write a short note on importance of dislocations? Also, Sketch and explain different type of dislocations. **4**

1C. What is hardening treatment? Differentiate between annealing and normalizing treatments. **2**

2A. Write short notes on:
(i) Grey cast iron (ii) HSS (iii) Bronze **4**

2B. Neatly sketch labelled Fe-Carbon equilibrium diagram. Write the structure and name the solid solution formed by peritectic reaction. **4**

2C. Explain:
(i) Carburising (ii) Induction hardening treatments. **2**

3A. With the help of phase diagram and any two cooling curves explain the binary system where the components show complete liquid solubility and solid insolubility also give one example for this system. **4**

3B. Neatly sketch labelled TTT diagram for Eutectoid steel and superimpose a normalizing cooling curve on it. **4**

3C. Sketch the following:
i) (1 0 4) ii) [2 1 3] iii) (2 1 0) iv) [0 2 5] **2**

4A. Melting temperatures of Silver and Copper are 960 and 1080^{o}C respectively. The metals Silver and Copper are mutually soluble in the liquid state and partially soluble in the solid state. A liquid phase alloy containing 30% Copper completely transforms into a mixture of two solid solutions at 780^{o}C. Maximum solubility of Copper in Silver and Silver in Copper are 8% and 12% respectively at 780^{o}C, 4% and 5% respectively at 600^{o}C. Assuming the curves to be linear, draw phase diagram to the scale and label the regions. For 30% Silver alloy, draw cooling curve and determine the following:

i) Temperature where equal proportions of liquid and solid phases exists.

ii) Weight ratio of two solids in the eutectic mixture. **4**

4B. With relevant neat sketches explain the procedure to draw hardenability curves in Jominy hardness test for eutectoid steel. **4**

4C. Differentiate between interstitial compounds & intermetallic compounds. Also give one example to each. **2**

5A. With the part of phase diagram and cooling curves (any two) briefly explain the solidification behavior of liquid cast iron on equilibrium cooling. **4**

5B. Explain the following with respect to solidification of metals:

i) Dendritic growth
ii) Degree of super cooling **4**
iii) Homogeneous nucleation.

5C. What do you mean by solid to solid state transformation invariant reaction? Name any one such system and draw ideal labelled phase diagram. **2**