

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

III SEMESTER B.TECH. (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: MATERIAL SCIENCE AND METALLURGY [AAE 2153]

REVISED CREDIT SYSTEM (02/01/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitable assumed.
- 1A. Two metals A and B used to form an alloy containing 75% A and 25% B. A melts at 650°C and B at 450°C. When alloyed together, A and B do not form any compound or intermediate phase. The solid solubility of metal A in B and B in A are negligible. The metal pair forms a eutectic at 40% A and 60% B which solidifies at 300°C. Assume the liquidus and solidus lines to be (04) straight. Draw the phase for the alloy series and find:
 - The temperature at which the alloy starts and completes solidification. i.
 - ii. The amount of liquid present and its composition, at a temperature of 390°C.
 - iii. Draw the cooling curve for the same.

1B.	Iron-Carbide equilibrium diagram is not a real equilibrium diagram. Define the statement.	(02)
1C.	Classify plain carbon steel with respect to carbon content. Also explain with respect to their properties and uses.	(04)
2A.	Sketch and explain the following crystal defects. a) Edge dislocation b) Schottky defect	(04)
2B.	Explain the following with respect to the solid solubilities of two components. a. Completely soluble b.Partially soluble.	(02)
2C.	What are the desirable properties of a good tool material?	(04)
3A.	Write short notes on a) Gibb's phase rule b) Hume Rothery rule	(04)
3B.	Name different point imperfections. Briefly explain any one.	(02)
3C.	What are the objectives of heat treatment of metals? Explain factors which affect the heat treatment process.	(04)
4A.	Sketch neatly TTT diagram for eutectoid steel and mark the phases. Also name the crystal structure of Martensite.	(05)
45		(05)

5A.	With relevant sketches explain the mechanism of solidification process.	(04)
	Sketch the part of the Iron- Carbon phase diagram to explain the pearlitic	

- Sketch the part of the Iron- Carbon phase diagram to explain the pearlitic5B. transformation from austenite. Name and explain the invariant reaction (04) involved in this region.
- **5C.** Sketch and distinguish between FCC and BCC basic crystal structures. (02)