Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

III SEMESTER B.TECH (MECHANICAL/I&P ENGG.) END SEMESTER MAKE-UP EXAMINATIONS, DEC 2017

SUBJECT: MATERIAL SCIENCE & METALLURGY – MME 2104

Time: 3 Hours

MAX. MARKS: 50

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Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- Use Graph sheets if required.
- 1 (A) Explain (i) Carburising (ii) Induction hardening treatments.
- 1 (B) Write the procedural steps for Miller Indices of crystallographic planes? Sketch the following Miller Indices :
 i) (203) ii) [124]
- 1 (C) Explain the procedural steps for the construction of Isomorphous type of binary phase diagram and also draw the labeled diagram for the same.

2 (A) Melting temperatures of metal A and metal B are 800°C and 1000°C respectively. Metal A and B are mutually soluble in the liquid state and partly soluble in the solid state. A liquid phase alloy containing approximately 40% B completely transforms into a mixture of two solid solutions at 500°C. Maximum solubility of B in A and A in B are approximately 10% and 20% respectively at 500°C, 5% and 10% respectively at 100°C. Assuming the solubility curves to be linear, draw phase diagram to scale and label the regions. For 60% B alloy determine the following:
a) Weight percentage of the eutectic mixture formed.
c) Composition of the liquid phase for the reaction.

- 2 (B) Write short notes on: (i) Plain carbon steel (ii) Bronze.
- 2 (C) Differentiate between homogeneous & heterogeneous solidification processes.
- 3 (A) With the help of part of phase diagram and heat treatment cycle explain the steps involved in annealing treatment of steel.
- 3 (B) Compute the atomic packing factor for the FCC unit cell and write its coordination number.
- 3 (C) Explain the formation of dendritic structure in spontaneous solidification process.
- 4 (A) With neat sketches, explain the procedure to plot the hardenability curves in standard 4

hardenability test.

4 (B)	Illustrate with example, the application phase rule in unary systems.	3
4 (C)	Write short notes on the following. i) Martensite ii) Bainite iii) Pearlite	3
5 (A)	Draw the neat proportionate sketch of the Iron-Carbide phase diagram and label all the salient points, lines and regions on it. Write the composition of the Fe- C alloy which shows lowest solidification temperature.	4
5 (B)	"Hume-Rothery rule is the guide for the selection of metal pair for substitutional type of solid solution." Explain the statement.	3
5 (C)	Sketch neatly labelled Isothermal Transformation diagram for 0.8wt.% carbon plain carbon steel.	3