Reg.No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

IV SEMESTER B.S. DEGREE EXAMINATION – OCT. / NOV. 2017

SUBJECT: MATERIAL SCIENCE AND METALLURGY (ME 245)

(BRANCH: MECH & MET)

Tuesday, 31 October 2017

Time: 3 Hours **Max. Marks: 100**

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Draw neat and proportionate sketches wherever necessary.**
- ✓ **Use of graph sheet is permitted.**

1A. What is a unit cell? With a neat sketch Briefly explain FCC and BCC.

1B. What are the differences between edge and screw dislocation?

1C. Show that the vacant space present in simple HCP cell is 26%, Also write the coordination number for simple HCP cell.

(6+6+8)

2A. With relevant sketches explain Homogeneous solidification process?

2B. What are the difference between homogeneous Nucleation and heterogeneous nucleation?

(10+10)

3A. What is a phase? Explain Gibb's phase rule for one component system.

3B. Explain solid solution. Explain the favorable conditions to obtain good substitutional and interstitial type of solid solutions.

(10+10)

4A. Explain with sketch, constructional procedure for simple binary phase diagram. Name the system and give an example for such system?

4B. With a neat sketch explain the changes in microstructure of binary alloy whose components are completely soluble in liquid state and completely insoluble in solid state, when cooled from liquid state. Also name the system.

(10+10)

5A. Two metals A and B have their melting points at 900°C and 800°C respectively. The alloy pair forms a eutectic at 600°C of composition 60% Band 40%A. A and B have unlimited mutual liquid solubilities.

Their solid solubilities are as follows:

10% B in A at 600°C and 5% B in A at 0°C

8% A in B at 600°C and 4% A in B at O°C

Assume the liquidus, solidus and solvus lines to be straight. No solid state reactions or any intermediate phase changes occur in the series.

i) Draw the phase diagram for the series and label all salient temperatures, compositions and regions.

ii) Find the room temperature structure of an alloy of composition 60% A and 40% B, with respect to the number, type, extent and composition of the phases.

5B. Sketch neatly iron cementite equilibrium diagram and mark the phases. Name the invariant reactions and write the reaction equation involved in the system.

(10+10)

6A. Sketch neatly Isothermal Transformation diagram for eutectoid steel and mark the phases. On the diagram superimpose the path to obtain Martensite and Bainite phase.

6B. What is hardenability? With a neat sketch explain end quench test.

(10+10)

7A. Define the term heat treatment and represent it graphically. Discuss the significance of various heat treatment process variables.

7B. Explain the following heat treatments with treatment cycle.

I. Annealing

II. Hardening

(10+10)

8A. Write short notes on:

I. High Speed Steel

II. White Cast Iron

8B. Write short notes on:

I. Bronze

II. Aluminum copper alloy

(10+10)