Reg.No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

IV SEMESTER B.S. DEGREE EXAMINATION

SUBJECT: MATERIAL SCIENCE AND METALLURGY (ME 245)

(BRANCH: MECH, MET & IP)

Friday, 21 April 2017

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

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Draw neat and proportionate sketches wherever necessary.**

1A) Explain different types of interstetial defects in crystals

1B) Derive the expression for critical size of nucleus in terms of degree of supercooling, change in enthalpy , surface tension and saturation temperature. **10+10**

2A) Write note on Dendritic Growth

2B) Explain the following with suitable examples,
i) Coordination Number ii) Packing factor iii) Effective Number of atoms
iv) Miller indices of planes v) Gibb's Phase Rule **10+10**

3A) Explain with example peritectic reaction

3B) Two metals A and B form an isomorphous system. The freezing range of various compositions of alloy is given in table Q 3B.

Alloy of composition

% B by weight		0	10	20	30	40	50	60	70	80	90	100
Freezing range in ^{0}C	Beginning	900	890	870	840	810	770	715	650	580	500	400
	End	900	790	700	630	570	525	485	450	425	405	400

Draw the phase diagram. Lable all the regions.
For 100 gms of an alloy with 40 % of B, determine the following
i) Composition of first crystal of precipitate
ii) the amount of liquid at 700^{0}C.
iii) Degrees of freedom at 600^{0}C
iv) Composition of solid at 600^{0}C
v) Temperature at which 30% liquid present. **10+10**

4A) Explain the structure, composition and properties of the following.
i) Ferrite ii) Austenite iii) Cementite iv) Pearlite and v) Ledeburite

4B) Draw the iron iron-carbide equilibrium diagram and explain the microstructural changes taking place on secondary crystallization cast iron with 3 % carbon . **10+10**

5A) Explain the procedure to develop TTT Diagram of eutectoid steel.

5B) Write note on tempering processes. **10+10**

6A) Define hardenability and explain the factors affecting the hardenability of steel.

6B) Explain the uses , limitations and any four applications of phase or equilibrium diagrams **10+10**

7A) Justify the following statements
i) The heating temperature range of annealing and hardening are same.
ii) Mild steel is not susceptible for hardening operation
iii) The shape of TTT Diagram is of S shape.
iv) It is not possible to produce 100 % Marensite at room temperature.
v) It is not possible to produce Bainite on continuous cooling.

7B) Explain the following case / surface hardening methods
i) Liquid Carburising, ii) Nitriding and iii) Induction hardening **10+10**

8A) Write note on High speed steel

8B) Explain the Black Heart process of producing malleable iron

8C) Explain the composition, properties and applications of following alloys
i) Tin Bronze ii) Gun Metal iii) Bell Metal and iv) Monel Metal **6+6+8**