

BT-4/M-24
MATERIALS ENGINEERING
ES-204A

44176

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

- (a) Niobium has an atomic radius of 0.1430 nm, atomic weight is 92.91 g/mol and a density of 8.57 g/cm³. Identify, whether it has an FCC or BCC crystal structure. 5
- (b) Differentiate between Edge Dislocation and Screw dislocation. 5
- (c) Why is it that dislocations play an important role in controlling the mechanical properties of metallic materials, however, they do not play a role in determining the mechanical properties of glasses ? Explain the role of grain boundaries on dislocation motion. 5

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P.T.O.

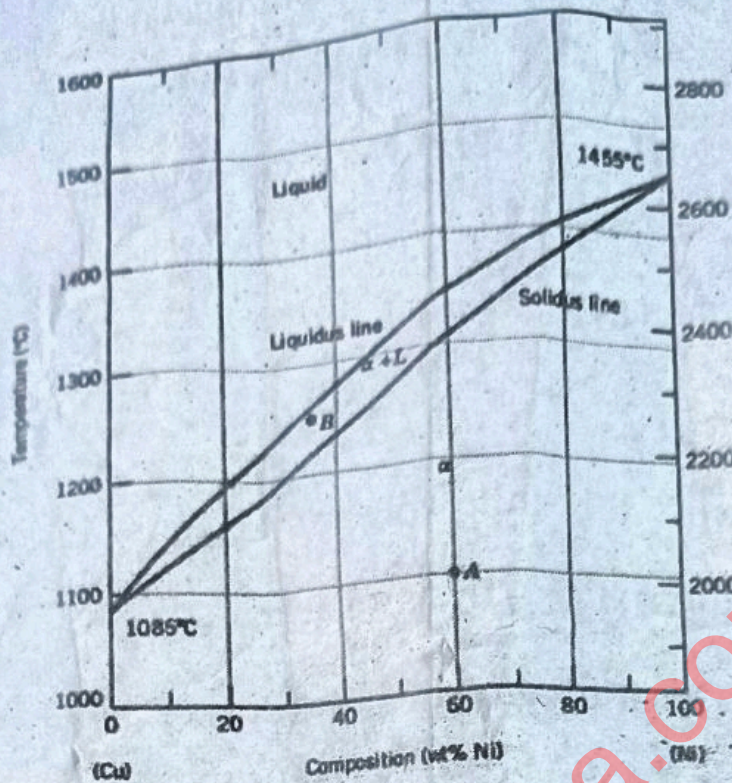
2. Illustrate the meaning of the following standard designations of various alloys and also identify the type of alloy : 15

- (a) FeE300P35
- (b) 35Mn6Mo3
- (c) XT75W18Cr4V1
- (d) AISI-316
- (e) 45C10S18.

Unit II

3. A copper-nickel alloy of composition 70 wt% Ni-30 wt% Cu is slowly heated from a temperature of 1300°C. 15

- (a) At what temperature does the first liquid phase form?
- (b) What is the composition of this liquid phase?
- (c) At what temperature does complete melting of the alloy occur?
- (d) What is the composition of the last solid remaining prior to complete melting?



4. (a) Draw Iron-Carbon diagram and show various invariant reactions on it. 8
- (b) Describe various surface hardening processes. 7

Unit III

5. Describe the following phenomenon related to deformation of materials : 15

- (a) Yield Point Phenomenon
- (b) Bauchinger Effect
- (c) Work hardening.

6. (a) Write factors which contribute to the onset of fatigue failure and those which tend to resist fatigue. 7
- (b) Sketch a typical creep curve and indicate important stages. Discuss the effect of grain size on creep strength. 8

Unit IV

7. Describe the following parameters involved in the metallographic analysis of a material : 15
- (a) Dendritic growth.
- (b) Coating thickness and integrity.
- (c) Inclusion size, shape and distribution.
- (d) Graphite nodularity.
- (e) Intergranular fracturing.
8. Explain the working of Transmission Electron Microscope (TEM) with a neat sketch. List down various advantages, limitations and applications of the TEM. 15