Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

Seat No.	

[4657]-13

S.E. (Mechanical & Mechanical (S/W)) (First Semester)

EXAMINATION, 2014

(METALLURGY-I)

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Figures to the right indicate full marks.

(*ii*) Assume suitable data, if necessary.

SECTION I

1. (A) Show the following planes and directions in a cubic cell : [4]

(*a*) (1 0 1)

(*b*) $(1\ \bar{1}\ 0)$

(*c*) [1 1 2]

(*d*) [1 2 1].

(B) Derive an expression for critical resolved shear stress in single crystal. How is plastic deformation in a polycrystalline material different from deformation in a single crystal ? [6]

P.T.O.

(C) Give the reasons for the following : [6]

(*a*) Copper is more ductile than iron. Do you agree ? Justify your choice.

(*b*) Substitutional and interstitial crystal defects improve the strength and hardness. Comment.

Or

2. (A) What are dislocations ? What are the types of dislocations ? Explain Screw and Edge dislocation. Define Burger vector. [6]

(B) Calculate resolved shear stress of a single crystal if applied tensile stress is 30 kg/mm^2 and slip plane is oriented at 45^o to the tensile axis ? [4]

(C) Why is annealing done after cold working ? Explain the changes in mechanical properties that take place during annealing with proper graphs. [6]

3. (A) What is creep ? How is creep test conducted ? [6]

(B) Why are impact test specimens notched ? What is the effect of temperature on impact strength ? [6]

(C) Explain the principle of ultrasonic flow inspection. State its advantages, limitations and applications. [4]

Or

4. (A) The steel specimen tested in standard tension test to evaluate mechanical properties. The data is given below : [8]

Diameter of the specimen = 12.5 mm

Original gauge length = 50 mm

Load at lower yield point = 45 kN

Load at upper yield point = 46 kN

Maximum load = 75 kN

Gauge length after fracture = 62.5 mm

Diameter at fracture = 80 mm

Stain at 20 kN = 7×10^{-4}

Calculate the following :

(*a*) UTS

(*b*) % Elongation and Modulus of Elasticity

(*c*) Modulus of resilience

(*d*) Modulus of toughness.

(B) Compare Brinel and Vickers Hardness Test. [4]

(C) Explain the principle of radiography with neat sketch. State its applications. [4]

5. (A) Draw the microstructures of AISI 1080 steel which is cooled to room temperature under equilibrium cooling condition. Find amounts of phases in it. [6]

(B) Explain the reasons for Widmanstatten structure. Is it desirable ? Justify your answer. [6]

(C) Compare and contrast between Ferritic, Austenitic and Martensitic stainless steels. [6]

Or

6. (A) Draw neat, labeled Fe-Fe3C equilibrium diagram. Explain slow cooling 0.4% C steel with neat sketches. [6]

(B) A slowly cooled steel contains 60% Ferrite and 40% Pearlite at room temperature. Determine the amount of total Ferrite and Cementite present in the alloy. [6]

(C) White cast iron finds limitations in engineering industry. True or False ? Justify your choice. State typical composition of white cast iron. [6]

SECTION II

7. (A) Draw T.T.T. curve for eutectoid steel. Explain the procedure for plotting T.T.T. curve for 0.8% C steel. [6]

(B) Distinguish between annealing and normalizing. [6]

(C) Explain the mechanism of austenite to martensite transformation and state characteristics of this transformation. What is retained austenite ? Is it desirable ? Justify. [6]

Or

8. (A) What is tempering ? Is it mandatory ? With a suitable graph, explain the variations in properties with tempering temperatures. [6]

(B) State True/False and justify (any *three*) : [6]

(*a*) Heat treatment is not required after carburizing.

(*b*) Plain carbon steels cannot be successfully Nitrided.

(*c*) Lathe beds are flame hardened.

(*d*) 0.1% carbon steel can be induction hardened.

(C) Distinguish between the following : [6]

(*i*) Cyaniding and liquid carburizing;

(*ii*) Flame and induction hardening.

9. (A) Enlist the powder production processes. Explain any *one* technique in brief. [6]

(B) Explain step-by-step manufacturing process for cemented carbide tools. [6]

(C) In sintering mandatory in P/M technique ? Justify in brief. [4]

Or

10. (A) Distinguish between Brass and Bronzes. [4]

(B) Enlist the properties required for the material to be bearing material. Write a brief note on Babbitts. [6]

(C) Suggest suitable non-ferrous material for the following applications, also mention compositions (any *three*) : [6]

(*a*) Cylinder head of diesel engine

(*b*) Bearings to be used in sea water

(*c*) Thermocouple wire

(*d*) Non-sparkling tools

(*e*) Aircraft components

(*f*) Measuring tape.

11. (A) Explain the characteristics of the following fibers used in composites (any *three*) : [6]

(*a*) Boron

(*b*) Silicon carbide

(*c*) Glass

(*d*) Aramid.

(B) Explain the property requirement for Biomedical materials. Justify Alumina and Zirconia as biomedical material. [6]

(C) Distinguish between Particle Reinforced and Fiber Reinforced composites. [4]

Or

12. Write short notes on (any *four*) : [16]

(*i*) Self-lubricated bearings

(*ii*) Powder conditioning;

(*iii*) Carbon-nanotubes;

(*iv*) General properties of ceramics;

(*v*) Powder Rolling;

(*vi*) Isostatic Pressing.