Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

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S.E. (Mechanical) EXAMINATION, 2009

METALLURGY

(2003 COURSE)

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

N.B. :— (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

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

SECTION I

1. (*a*) Distinguish between Screw and Edge dislocation. Also explain the effects of point defects on various properties of materials. [6]

(*b*) Is cold working always superior to hot working ? Explain. [4]

(*c*) Derive an expression for CRSS of a single crystal. Calculate resolved shear stress of a single crystal if applied tensile stress is 30 kg/mm^2 and slip plane is oriented at 45° to the tensile axis ? [6]

P.T.O.

Or

2. (*a*) What is a slip system ? Why is copper more ductile than Iron ? [4]

(*b*) Why strain hardening is more in fine grained material ? [3]

(*c*) Explain the following in brief (any *three*) : [9]

(*i*) Point defects

(*ii*) Recrystallisation

(*iii*) Polygonization

(*iv*) Dislocation.

3. (*i*) What is Barba's law ? What is its significance ? Derive the relationship between :

(*a*) engineering stress and true stress

(*b*) engineering strain and true strain. [6]

(*ii*) Which NDT method do you suggest to sort out steel bars of same shape and size but with different chemical composition ? Explain only the principle of that test. [4]

(*iii*) Draw a typical S-N curve for Al and Steel. Explain why these curves differ from each other. Define fatigue limit. [6]

(*iv*) Which hardness test do you recommend for High speed steel tool Gray iron casting ? [2]

Or

4. (*a*) Explain what is Creep ? When it is of great significance ? Draw a typical creep curve. [6]

(*b*) Differentiate between Charpy and Izod impact test. [5]

(*c*) Draw a typical fatigue fracture. Suggest ways to improve fatigue life of a component. [5]

(*d*) Draw typical engineering stress-engineering strain curves for mild steel and copper. [2]

5. (*a*) Draw Fe-Fe_3C equilibrium diagram (not to scale but proportionate). Give all the details on it. (No written explanation is required) Write various reactions of Fe-Fe_3C system with all details. [6]

(*b*) Define Ferrite, Pearlite, Cementite and Killed steel. [4]

(*c*) Which steel would you recommend for the following applications ? Justify your choice (any *three*) : [6]

(1) Household utensils

(2) RCC bars

(3) Crankshaft

(4) Master gauge

(5) Nuts.

Or

6. Answer the following : [16]

(*a*) Distinguish between Killed and Rimmed steel.

(*b*) Draw the microstructure of AISI 1080 steel which is cooled to room temperature under equilibrium cooling condition. Find amounts of phases in it.

(c) Discuss the effects of Tungsten and Chromium on properties of steel.

(d) Which steel do you suggest for the following applications ? Justify your choice (any *two*) :

(1) Milling cutter

(2) Taps

(3) Fan blades

(4) Surgical Instruments.

SECTION II

7. (a) State True/False and justify (any *four*) : [12]

(1) Hypereutectoid steels are hardened from above Acm temperature.

(2) Hardness increases during tempering.

(3) Annealed steel is harder than normalised steel.

(4) Heat treatment is not required after carburising.

(5) Plain carbon steels cannot be successfully nitrided.

(b) What is carbonitriding ? Explain in brief stating its advantages over carburising. [6]

Or

8. (a) Differentiate between Carburising and Nitriding. [4]

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

(c) What is Hardenability ? How is it measured ? [4]

(d) Distinguish between TTT and CCT diagram. [4]

9. (*a*) Suggest suitable non-ferrous material for the following applications (any *four*), mention composition also : [8]

(1) Coins

(2) Piston

(3) Turbine blades

(4) Costume Jewellery

(5) Bell

(6) Gun barrel.

(*b*) Compare S.G. iron and Malleable iron with respect to micro-structure, production, composition and *one* application. [8]

Or

10. (*a*) In what respect cast iron is different than steel ? [3]

(*b*) White cast iron finds limited applications in engineering in industries. Do you agree/disagree ? Justify your choice. [3]

(*c*) Suggest suitable non-ferrous material for the following applications (any *five*), mention composition also : [10]

(1) Imitation Jewellery

(2) Piston

(3) Cylinder head of diesel engine

(4) Bearings to be used in sea water

(5) Thermocouple wire

(6) Non-sparking tools

(7) Aircraft components

(8) Measuring tape.

11. (*a*) Explain the following terms : [6]

(*i*) Apparent density

(*ii*) Compressibility

(*iii*) Green spring.

(*b*) What is sintering ? Explain in brief. [4]

(*c*) With a neat sketch, explain working of total radiation pyrometer. Mention its working range of temperature. [6]

Or

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

(1) Cemented carbides;

(2) Particle size and its distribution

(3) Types of thermocouple

(4) Optical pyrometer

(5) Atomization

(6) Advantages of Powder Metallurgy.