Code No: RR311802 **Set No.1**

III B.Tech. I Semester Regular Examinations, November -2005
MECHANICAL METALLURGY
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain how cross slip of dislocations is related to stacking fault energy in FCC structure.
   (b) Distinguish between dislocation Jog and dislocation Kink, with neat sketches. [8+8]
2. (a) Explain the working principle of shore scleroscope test.
   (b) Explain the basis for selection of loads in Briunell′s hardness test method. [8+8]
3. Define and explain the following:
   (a) Stiffness
   (b) Resilience and modulus of resilience
   (c) Toughness
   (d) Strain hardening
   (e) Strain rate sensitivity [3+4+3+3+3+]
4. (a) Explain the effects of carbon content of steels, grain size and shape, crystal structure on transition temperature.
   (b) Describe with neat sketches the principles of Izod test. [8+8]
5. (a) What do you mean by fracture? Explain the various types of fractures?
   (b) Obtain Griffth′s criterion for propagation of a crack in a brittle material.[8+8]
6. (a) Describe in detail any one test for evaluating the fatigue strength and explain how the data is used to obtain fatigue limit.
   (b) Explain various mechanisms of fatigue failure. [8+8]
7. Write about
   (a) Various types of creep resistant materials.
   (b) Importance of creep at high temperature. [8+8]
8. Explain the following N.D.T Processes.
   (a) Magnetic particle inspection
   (b) Ultrasonic flaw detection [8+8]

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Code No: RR311802 **Set No.2**

III B.Tech. I Semester Regular Examinations, November -2005
MECHANICAL METALLURGY
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain how cross slip of dislocations is related to stacking fault energy in FCC structure.
   (b) Distinguish between dislocation Jog and dislocation Kink, with neat sketches. [8+8]

2. (a) Explain the working principle of shore scleroscope test.
   (b) Explain the basis for selection of loads in Briunell′s hardness test method. [8+8]

3. (a) What is the significance of 'point of instability' in a tensile test.
   (b) Explain what do you mean by 'Dislocation pile up'. What is the influence of the above phenomenon on the properties del and behaviour of materials?
   (c) Explain why Brinnell′s hardness test is preferred for cast Irons. [5+6+5]

4. (a) Discuss the factors affecting ductile to brittle transition in FCC and BCC metals.
   (b) Discuss the factors affecting the impact properties of materials
   (c) How is impact strength measured? [6+6+4]

5. (a) Explain the Griffth′s theory of metals.
   (b) Distinguish between ductile and brittle fracture of metals. Draw stress-strain diagrams for both the types of failures with suitable examples. [8+8]

6. (a) What is fatigue fracture? How the fractograph looks like? Explain it.
   (b) What factors affect the fatigue failure of metals? [8+8]

7. Write about
   (a) Various types of creep resistant materials.
   (b) Importance of creep at high temperature. [8+8]

8. What the Nondestructive tests you advise for the following. Give reasons for selection of such a process.
   (a) Aviation components.
   (b) Weldments of steel used in pressure vessals.
   (c) Forged axels.

(d) Cold rolled bars of Titanium.

(e) Surface cracks on tubes. [3+4+3+3+3+]

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Code No: RR311802 **Set No.3**

III B.Tech. I Semester Regular Examinations, November -2005
MECHANICAL METALLURGY
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain how do changes in the dislocation density affect the strength and ductility of metals.
   (b) Compute the line energy of dislocations in FCC Aluminium. The Burger′s vector in Aluminium is $\frac{1}{2} < 110 >$. The shear modulus of Aluminium is 28.4 Gpa. [8+8]

2. (a) Explain why the hardness of a materials is of interest to each of the following:
      i. Machinist
      ii. Design engineer
      iii. Mine ralogist
      iv. The testing engineer.
   (b) Discuss specific hardness tests used for measuring hardness of Nitrided cases. [10+6]

3. (a) Give an expression relating true stress with true strain. Explain the terms involved in the relation. Also explain how true stress varies with strain ratio.
   (b) Write short notes in the following:
      i. SESSILE dislocations
      ii. Hall-PETCH Equation/relation [6+10]

4. (a) Distinguish clearly between notch toughness; notch brittleness and notch sensitivity.
   (b) Discuss the effect of the type of notch and velocity of the hammer on the results of the impact test. [9+7]

5. (a) A sample of glass has a crack of half length 2mm. The young′s modulus of glass 70GN/m^2 is and specific surface energy is 1J/m^2 . Estimate the fracture strength and compare it with its young?s Modulus.
   (b) Explain Ductile-Brittle transition temperature in metals. [9+7]

6. (a) What do you mean by fatigue of metals? What factors aid fatigue failure?
   (b) Draw S-N curve for a mild steel, Al-alloy and a Nickle alloy. Discuss about their endurance limits. [7+9]

7. (a) Describe an experiment with instrumentation details to conduct a creep test for short duration.

(b) Explain parametric methods of creep correlation for pridiction of long time properties. [8+8]

8. (a) Explain the principle and working of Radiographic NDT with a neat sketch.
   (b) Expalin various methods of Magnetization. [8+8]

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Code No: RR311802 **Set No.4**

III B.Tech. I Semester Regular Examinations, November -2005
MECHANICAL METALLURGY
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the successive stages in the operation of a FRANK - Reed source.
   (b) With the help of sketch, explain the formation of sessile dislocations result in work hardening of FCC metals. [8+8]

2. (a) What are the limitation of Brinnell's hardness test? Why should we adopt Rockwell hardness test? What necessiates employment of A, B & C scales in Rockwell test.
   (b) An engineer claims that metal 1 is harder then metal II when tested by Brinell test, But metal II is harder than metal 1 when tested by Rockwell test. Justify his claim and explain the reasons. [8+8]

3. (a) Discuss the shear stress-shear strain diagram for FCC single crystals.
   (b) Explain why the strength of brittle materials is usually larger in compression than in tension. [8+8]

4. (a) Explain the significance of equicohesive temperature.
   (b) Explain clearly the mechanism of brittle fracture in metals.
   (c) Discuss in detail the significance and test methods for fracture toughness. [5+5+6]

5. (a) Why brittle materials are used more often in compression than in tension in structural design?
   (b) Prove that the theoretical cohesive strength of metals is $\sigma_{\max} = \left[\frac{E\gamma_s}{a_o}\right]^{1/2}$
   Where$\sigma_{\max}$ = maximum stress
   E = youngs Modulus
   γ_s = surface energy
   a_o = distance between two atoms.

   [6+10]

6. (a) What do you mean by fatigue of metals? What factors aid fatigue failure?
   (b) Draw S-N curve for a mild steel, Al-alloy and a Nickle alloy. Discuss about their endurance limits. [7+9]

7. (a) Explain the Naborro mechanism of creep.

(b) Explain the role of super alloys and dispersion strengthed alloys for high temperature creep. [8+8]

8. (a) How Eddy current NDT works? Explain the working principle in detail.

(b) In which type of components this test is used. What are its disadvantages? [9+7]

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