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

III B.Tech I Semester Regular Examinations, November 2006
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 yield strength is related to grain size of ploy crystalline materials.
   (b) Explain how dislocation energy can be expressed in terms of Burger′s vector. [8+8]

2. (a) Derive an expression for the vicker′s hardness number with the help of a neat sketch of the indentation.
   (b) Discuss the principle, operation and applications of Microhardness test. [8+8]

3. Explain the following terms:
   (a) SECANT MODULUS
   (b) Modulus of Resistance
   (c) Tenacity [5+6+5]

4. (a) What is transition temperature? Discuss the effect of various metallurgical factors affecting the transition temperature
   (b) Discuss the standard test for determining the transition temperature. [8+8]

5. (a) A sample of glass has a crack of half length 2μm. The young′s modulus of glass 70GN/m^2 is and specific surface energy is IJ/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 are the various types of fatigue cycles that are possible? Explain them.
   (b) What are the metallurgical variables which control fatigue? Explain. [8+8]

7. (a) Explain any three types of preventive measures taken to enhance the creep life of components.
   (b) IExplain the creep mechanisms? [8+8]

8. What is the importance of N.D.T in engineering? Explain the following tests.
   (a) X-Ray Radiography
   (b) Liquid penetrant test. [8+8]

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

III B.Tech I Semester Regular Examinations, November 2006
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) What is meant by Burger′s vector? Draw a Burger′s circuit to show the magnitude and direction of Burger′s vector on a crystal having
   i. Edge dislocation and
   ii. Screw dislocation.
   (b) Explain the phenomenon of cross slip in screw dislocations. [10+6]
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) Explain how yield stress can be determined for materials which do not exhibit a distinct yield point.
   (b) How is true stress calculated? Derive the relationship between conventional stress and true stress. [8+8]
4. (a) Discuss the metallurgical factors applied to reduce DBTT.
   (b) How the DBTT can be determined. [8+8]
5. (a) Under what conditions a ductile material may fail in a brittle manner? Explain about Ductile-Brittle transition temperature.
   (b) What do you mean by fracture toughness? Explain. [9+7]
6. (a) Explain crack initiation and propogation failure with the aid of a sketch.
   (b) What preventive measures can be adopted to avoid fatigue failure? [8+8]
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. 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 2006
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. What is a slip systems. Calculate the number of slip systems in simple cube, BCC, FCC and CPH unit cells. Draw a neat sketch to show slip systems in FCC structures. [16]

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) The tensile test is the most important test carried out on constructional steels. Give reasons and explain the test procedure and properties determined.
   (b) Explain the term 'off set yield strength'.
   (c) Explain why percent elongation in a tensile test depends on gauge length.
   (d) Define and explain modulus of toughness of a tensile test. [4x4=16]

4. (a) Explain how temper embrittlement can be avoided.
   (b) Explain the factors that affect ductile to Brittle transition temperature for steels. [6+10]

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) Explain the principle and inspection of liquid penetrant N.D.T?

(b) What are the limitations of this test compared to other tests? [8+8]

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

III B.Tech I Semester Regular Examinations, November 2006
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) What are partial dislocations. Explain with a sketch and examples.
   (b) Discuss the movement of dislocations at elevated temperatures as related to creep strain. [8+8]
2. Explain the principle and operation involved in Rockwel hardness test. What are the major advantages and limitations of this test over other hardness tests? [16]
3. (a) Explain the phenomena of sharp yield point.
   (b) Explain the plasticity of FCC;BCC and CPH single crystalline materials.[7+9]
4. (a) Explain the factors for lowering ductile to brittle transition temperature of steel plates used for ship hulls.
   (b) Explain how the effect of small notches or cracks can be analysed in terms of fracture toughness. [8+8]
5. (a) A sample of glass has a crack of half length 2μm. The young′s modulus of glass 70GN/m^2 is and specific surface energy is IJ/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 is fatigue fracture? How the fractograph looks like? Explain it.
   (b) What factors affect the fatigue failure of metals? [8+8]
7. (a) Give an account of the various factors which influence the creep behaviour of metals.
   (b) What structural changes take place during creep deformation in metals?[8+8]
8. Explain the following N.D.T Processes.
   (a) Magnetic particle inspection
   (b) Ultrasonic flaw detection [8+8]

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