ET-204(A)

B.Tech. Civil (Construction Management)

Term-End Examination

December, 2012

01941

ET-204(A) : MATERIALS SCIENCE

Time : 3 hours   Maximum Marks : 70

Note :   Answer *any seven* questions. All questions carry *equal* marks. Use of scientific calculator is *permitted*.

1. (a) The distance between two atoms is   5
         increasing. Show how the interatomic
         potential energy will vary. At which point
         it will be minimum.

    (b) Write an expression for interatomic forces   5
         between two atoms when they are at a
         distance of r. Show how would you obtain
         expression for the potential energy of the
         bond.

2. (a) With three sides a, b and c angle α between   6
         a and b, β between b and c and γ between c
         and a, define seven systems of crystal and
         show on diagram.

    (b) Define Miller indices. Show planes (1 1 0)   4
         and (1 1 1) with the help of sketches.

3. (a) Describe defects in crystal. Show point and line defects. **5**

   (b) What is Burger vector ? How could you determine it ? If a stress (shear) T is acting parallel to slip plane of a dislocation of Burger vector b, what force acts upon dislocation ? **5**

4. (a) A mild steel tension specimen is loaded in a UTM just beyond yield point where strain hardening has begun. Draw the stres-strain diagram marking characteristic points and showing the deformation during yielding. If the specimen is unloaded from this point, show the unloading line on the same diagram and mark the strain that has been recovered and that has not been recovered. **6**

   (b) Define percentage elongation and explain why the final length (i.e length after fracture) is measured by joining two broken parts. **4**

5. (a) Define a phase and state Gibb's equation for phase rule. Define triple point in phase diagram of water and show that degree of freedom at this point is zero. What is the degree of freedom if single phase liquid exists ? **7**

(b) Show the equilibrium diagram of alloy of Ni (60%) and Cu (40%). Define liquidus and solidus. 3

6. (a) What is a TTT diagram ? What is its utility. How can you obtain a desired phase by the help of TTT diagram of steel ? Show and explain with the help of figure. 6

(b) Describe Jominy Test for hardenability. 4

7. (a) What is corrosion ? Describe Galvanic corrosion and Galvanic protection. 5

(b) Describe season cracking and caustic embrittlement. 5

8. (a) Define thermal coefficient of expansion. What is thermally isotropic material ? Explain thermal expansion of a solid with the help of energy curve between atoms. 5

(b) Through which mechanisms the heat travels through solid. Distinguish between a conductor and insulator based upon these mechanisms. 5

9. (a) Distinguish amongst electrical conductors, semiconductors and insulators. Give examples of each class. 5

(b) What is piezoelectricity ? Mention a few   **5**
     piezoelectric materials.   What are
     applications of these materials ?

10. What do you understand by elastic isotropy.   **10**
     How many elastic constants are required to
     define elastically isotropic material ? Are plastics
     (polymeric materials) elastic ? What are two
     basic types of plastics ? How does the
     reinforcement by fibre increases utility of plastics
     for carrying load ?

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