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BIME-005

B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

00405

Term-End Examination

December, 2014

BIME-005 : MATERIAL SCIENCE

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***seven*** *questions. All questions carry equal marks.*

1. (a) State how carbon content influences the strength and ductility of plain carbon steels.

(b) State how the properties of alloy steels are affected by following alloying elements : Manganese, Chromium and Tungsten. *5+5*

2. (a) Write down the composition of two copper based alloys and their applications.

(b) Explain the necessity of heat treatment for steels. Describe the process of quenching. *5+5*

3. (a) Describe in brief the time-temperature transformation curve for steel.

(b) Explain in brief the case hardening process. *5+5*

4. (a) Explain how the toughness of a material is measured.

   (b) Define intrinsic and extrinsic semiconductors. Explain how holes and electrons are created in an intrinsic silicon semiconductor. *5+5*

5. (a) Does the Burgers' vector change with the size of the Burgers' circuit ? Explain.

   (b) What do you mean by dislocation ? Explain edge dislocation and line dislocation. *5+5*

6. (a) What are the eutectoid and eutectic reactions in the Fe – C binary phase diagram ? Explain.

   (b) Define the following terms :
   (i) Tensile strength
   (ii) Yield strength
   (iii) Impact strength
   (iv) Creep
   (v) Fatigue *5+5*

7. (a) Draw a stress-strain diagram and illustrate the following :
   (i) Elastic limit
   (ii) Yield stress
   (iii) Ultimate tensile strength

   (b) Explain the meaning of critical rate of cooling. Specify the critical cooling rate of any two plain carbon steels. *5+5*

8. (a) Discuss the major defects in steel due to faulty heat treatment.

(b) How are the mechanical properties controlled by hardening followed by suitable tempering ? *5+5*

9. (a) What are the ceramic materials ? Explain the polymorphism in ceramic materials. Give uses of ceramics.

(b) Explain the type of structure and molecular arrangement desired for producing synthetic fibres and rubbers. *5+5*

10. (a) Distinguish between paramagnetism and ferromagnetism, explaining the mechanisms involving electron spins.

(b) Define the following : (any ***five***)

(i) Dielectric materials

(ii) Free electron theory in metals

(iii) Doping in semiconductors

(iv) Curie temperature

(v) Periodic table

(vi) Chemical bonding

(vii) Atomic packing factor

(viii) NDT *5+5*
