| BME-060 |

DIPLOMA IN MECHANICAL ENGINEERING (DME)

Term-End Examination

00530

June, 2016

BME-060 : MACHINE DESIGN

Time : 2 hours　　　　　*Maximum Marks : 70*

Note : Question no. 1 is **compulsory**. Attempt any **five** questions from the remaining questions. Use of calculator and data book is permissible.

1. Select the correct answer from the alternatives given below each question.　　*10×2=20*

    (i) Addition of chromium in steel

    (a) increases hardness

    (b) increases toughness

    (c) increases hardness and toughness

    (d) increases hardness but decreases toughness

(ii) The proportionality constant relating to the contraction to the primary strain is called

    (a) modulus of elasticity

    (b) shear modulus

    (c) Poisson's ratio

    (d) None of the above

(iii) A solid shaft can resist a bending moment of 3·0 kNm and a twisting moment of 4·0 kNm. The equivalent torque is

    (a) 7·0 kNm

    (b) 3·5 kNm

    (c) 5·0 kNm

    (d) None of the above

(iv) In the assembly design of shaft, pulley and key, the weakest member is

    (a) pulley

    (b) key

    (c) shaft

    (d) None of the above

(v) According to Unwin's formula the diameter of the rivet hole is obtained from

    (a) $1 \cdot 6 \sqrt{t}$

    (b) $1 \cdot 6\, t$

    (c) $6 \cdot 0\, t$

    (d) $6 \cdot 0 \sqrt{t}$

(vi) The closest throat area of a fillet weld, with equal legs of 7 mm and length 12 mm, is

(a) 84 mm^2

(b) $59 \cdot 4 \text{ mm}^2$

(c) $118 \cdot 8 \text{ mm}^2$

(d) $71 \cdot 5 \text{ mm}^2$

(vii) Metric threads are classified as

(a) coarse series

(b) fine series

(c) Both the above

(d) UNR series

(viii) A flexible coupling can be used for

(a) axial misalignment

(b) angular misalignment

(c) Both the above

(d) Can only be used for aligned shaft

(ix) Preloading of the bolts

(a) improves the factor of safety

(b) prevents leakage

(c) reduces the factor of safety

(d) secures parts tightly

(x) The ratio of modulus of rigidity G and modulus of elasticity E for any isotropic elastic material for a given Poisson's ratio 0·5 is

(a) 1/4

(b) 2/3

(c) 2/5

(d) 1/3

2. Design a hollow shaft made of 45C8 steel to transmit 10 kW at 900 rpm. The ratio of inner diameter to outer diameter is to be kept 0·65. The length between the two bearings is 7·0 m. The weight of the shaft is 8 kN. Assume minor shock factor 1·5. The yield strength and ultimate strength of 45C8 steel are 380 MPa and 630 MPa respectively. *10*

3. Design a triple riveted lap joint with zigzag riveting for joining two plates of thickness 10 mm. Allowable tensile stress is 60 MPa. Use empirical relation to compute shear stress and crushing stress from allowable tensile stress. Draw and show the dimensions. Determine the efficiency of the joint. *10*

4. A 200 mm long hollow shaft of external diameter 80 mm and internal diameter 50 mm is welded to a plate along its circumference. The shaft carries a concentrated load of 15 kN at the free end perpendicular to the shaft axis. If permissible weld strength is 143 MPa, determine the weld size.   *10*

5. Design and draw a cotter joint to support a load of 35 kN. The allowable stresses in tension, shear and crushing are 56 MPa, 45 MPa and 98 MPa respectively.   *10*

6. Design a square key for fixing a gear on the shaft having 25 mm diameter. The gear rotates at 550 rpm and transmits 12 kW power to the meshing gear. The key is made of steel having yield strength in tension as 400 MPa. The yield strength in compression and tension may be taken as equal to each other. Assume the factor of safety as 2·5.   *10*

7. Write short notes on any *two* of the following :   *2×5=10*

   (a)   Stress – Strain diagram of mild steel

   (b)   Heat treatment of steel

   (c)   Application of power screw

8. Write the procedure for designing a flange coupling to connect two coaxial shafts of an electric motor and worm and worm wheel reducer. *10*