No. of Printed Pages : **5 + Drawing Sheet**

BIME-008

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

01131

December, 2012

BIME-008 : MACHINE DESIGN - I

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any five** questions. All questions carry **equal** marks. Use of Scientific calculator is permitted. Use of Design Data Book is permitted.*

1. (a) (i) In designing a cotter joint, factor of safety for cotter is taken higher. Explain why ? **6+8**

(ii) How is cotter joint different from Knuckle joint ?

(b) Design a cotter foundation bolt to carry an axial tensile load of 15 kN. The bolt and cotter can be taken as made of same material and the allowable stresses are

$\sigma_d = 50$ N/mm^2;

$\sigma_{dc} = 60$ N/mm^2; and

$\tau_d = 30$ N/mm^2.

2. (a) (i) What do you understand by stress concentration ? 6+8

(ii) What is the difference between endurance limit and fatigue strength of a material ?

(b) Design a 'Knuckle joint' to connect two mild steel rods. The joint has to transmit a tensile load of 70 kN.

Assume $S_{yt} = 400$ N/mm^2, factor of safety = 5.

3. (a) What information do you obtain from Soderberg diagram ? 6+8

(b) Design a helical spring to support a tensile load of 6 kN and to have a stiffness of 100 N/mm. The spring is made of steel having allowable stress of 300 MPa. Take G = 80 GPa.

4. (a) (i) Why are metals in their pure form not suitable in industrial application ? 6+8

(ii) Give five machine elements which can be manufactured by casting.

(b) A railway wagon weighing 50 kN and moving with a speed of 8 km/hr has to be stopped by four buffer springs in which the maximum compression allowed is 220 mm. Find the active no. of coils in each spring of mean coil diameter is 150 mm. The wire diameter is 20 mm. Also find the shear stress in each spring. Take G = 84 GPa.

5. (a) Write down the materials used for the following : 6+8

(i) Bolts

(ii) Laminated spring

(iii) Air craft body

(iv) Bracket

(v) Shaft

(vi) Flange

(vii) Keys

(viii) Piston of Hydraulic press

(ix) Screw jacks

(x) Bearings

(xi) Fly wheels

(xii) Rivets

(b) An automotive leaf spring is fitted over a span of 1.1 m with a central band of 0.1 m. The central load is 72 kN. The spring has 2 full length and 10 graduated leaves. Allowable bending stress is 390 MPa. The ratio of total depth to width = 2. Determine

(i) The size of leaves

(ii) The initial gap between full length and graduated leaves

(iii) Load on band.

6. (a) A hole is dimensioned as $25^{+0.033}_{+0.00}$ and the shaft is dimensioned as $25^{-0.040}_{-0.061}$ (dimension in mm). Determine the hole tolerance, the shaft tolerance and allowance of the fit. What type of fit shall be established ? 6+8

(b) A single start screw with 48 mm nominal diameter and pitch 40 mm is used to raise a load of 10 kN. The coefficient of friction between the screw and the nut is 0.12. Calculate the torque required to over come friction while raising and lowering the load and efficiency of the screw.

7. (a) Why are tolerances provided on dimensions of the components ? Explain different types of fit with suitable examples. 6+8

(b) The shaft and flange of a marine engine are to be designed for a flange coupling in which flange is forged on the end of the shaft. Following particulars are to be considered

Power of engine = 3 MW

Speed of engine = 100 rpm

Shear stress for bolt and shaft = 60 MPa

No. of bolts used = 8

PCD of bolts = 1.6 × (dia of shaft)

Find :

(i) Dia of shaft

(ii) Dia of bolts

(iii) Thickness of flange

(iv) Diameter of flange

8. Write short notes on ***any four*** of the following : **4x3½=14**

(a) Fatigue failure

(b) Design for Rigidity

(c) Failure theories

(d) Factor of safety

(e) Hydraulic Press

(f) CAD