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4E4143

B.Tech. IVsem(Main/Back) Examination ,June/July- 2015

Mechanical Engg

4ME4 Design of Machine Elements-I

Common with Automobile

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

*Attempt any **five** questions, selecting one question from **each unit**. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Unit - I

1. a) What are the various types of fits? Explain them with the help of neat diagrams. Give an example of each. **(6)**

   b) Represent the following on a suitable diagram: Upper deviation, lower deviation, Fundamental deviation, Tolerance zone, Basic size **(4)**

   c) What precautions should be observed while designing a Forging. **(4)**

   d) The 'cost' factor influence the material selection. Explain. **(2)**

OR

1. a) Write a note on 'Design for Assembly'. **(4)**

   b) Manufacturing consideration is an important material selection criterion. Explain. **(4)**

   c) The surface roughness is limited by the manufacturing method used. Explain. **(4)**

   d) Explain the meaning of designation of the following steel:

   i) 55 C8 ii) 16 Ni_3 Cr_2 **(4)**

Unit - II

2. a) Compare ductile and brittle failure with the help of theories of failure. **(4)**

b) Discuss the methods of stress concentration mitigation. Give suitable diagrams. **(6)**

c) What types of stresses are induced in a cotter of the cotter joint when subjected to tensile load and also, give the expression for the respective resisting area along with suitable diagrams. **(6)**

OR

2. Design a knuckle joint to connect two round rods subjected to a tensile load of 100 kN. The permissible stresses may be taken as 75 MPa in tension, 50 MPa in shear and 135 MPa in crushing. **(16)**

Unit - III

3. a) Give steps to design a cantilever beam for stiffness. **(6)**

b) What is the objective of nipping of leaf spring. **(4)**

c) How the pin-joint at eye-end in the leaf spring is designed? **(6)**

OR

3. Design a cranked lever for the following data:

Length of handle = 200 mm

Length of the lever arm = 300 mm

Overhung of the shaft from the fournal = 50 mm

Effort applied by an average person = 400 N

The shaft is also to be designed. The permissible stresses are:

Lever : $\sigma_t = 70 MPa,\ \tau = 50 MPa$

Shaft: $\tau = 40\ MPa,\ \sigma_{cr} = 102\ MPa$ **(16)**

Unit - IV

4. Power is transmitted by a shaft 900 mm long and is supported at the ends. A pulley of diameter 420 m is placed at 150 mm to the left of right hand bearing and another pulley of diameter 270 mm is mounted midway between the bearings. Determine the diameter of the shaft transmitting 24 kW at 300 rpm using both maximum shear stress theory and maximum normal stress theory.

The permissible tensile and shear stresses for shaft material are 120 MPa and 80 MPa respectively. The belt drives are at right angles to each other with tensions ratio as 3:1 **(16)**

OR

4. a) Design a muff coupling to transmit 6.5 kW at 1000 rpm. The permissible shear stress for shaft, key & muff is 50 MPa and permissible crushing stress for key is 120 MPa. **(10)**

   b) For a rigid flange coupling (shaft diameter 'd') transmitting torque T, give design equation/procedure to calculate:

      i) Flange thickness

      ii) Bolt diameter **(6)**

Unit - V

5. a) Find the diameter of bolts used to connect the bracket as shown is Figure.1

   Given: l=650 mm, a=100mm, b=150 mm, p=5kN The permissible shear stress is 40 MPa. **(10)**

   b) What are the different types of stresses induced in the bolts due to initial tighting and give their expressions. **(6)**

OR

5. a) What is self-locking screw? How is it achieved? **(4)**

   b) A U-frame, made of cast steel, has a maximum force of 70kN as shown in Figure 2. The cross-section of the frame is 125×b (rectangular). Determine the dimension 'b'. Using straight beam formulae and curved beam formula. Take stress concentration/correction factor a 1.4. The permissible tensile stress is 100 MPa. **(12)**

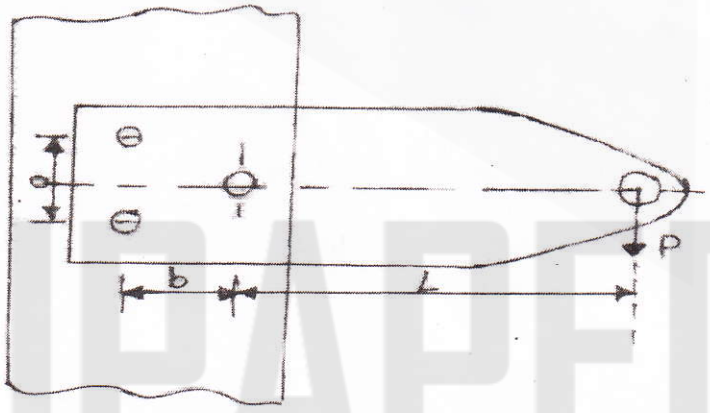

Figure-1 **(Q.5 a)**

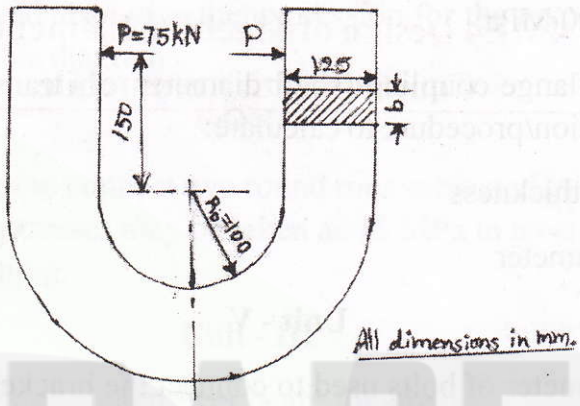

Figure -2

(Q.5 b OR)