BAS-010

B.Tech. AEROSPACE ENGINEERING (BTAE)
Term-End Examination
December, 2015

BAS-010 : MACHINE DESIGN

Time : 3 hours   *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Assume missing data, if any. Use of calculator is permitted. Use of Machine Design Data Book is permitted.*

1. (a) State the functions of the following machine elements :   5

   (i) Shaft

   (ii) Spring

   (iii) Coupling

   (iv) Bearing

   (v) Screw fastening

   (b) Name the types of failures in the following machine elements :   5

   (i) Transmission shafts

   (ii) Gears

   (iii) Ball bearings

   (iv) Springs

   (v) Clutches

2. Design a lap joint for a mild steel flat tie-bar 200 mm × 10 mm thick, using 24 mm diameter rivets. Assume allowable stresses in tension and compression of the plate material as 112 MPa and 200 MPa respectively and shear stress of the rivets as 84 MPa. Show the disposition of the rivets for maximum joint efficiency and determine the joint efficiency. Take diameter of the rivet hole as 25·5 mm for a 24 mm diameter rivet. *10*

3. A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm^2, find the axial load which the spring can carry and the deflection per active turn. The effect of curvature may be neglected. *10*

4. A vertical two start square threaded screw of 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift and lower the load. The coefficient of friction for the vertical screw and nut is 0·15 and that for collar bearing is 0·20. *10*

5. Write short notes on the following mechanical properties of engineering materials : *5×2=10*

    (a) Hardness

    (b) Brittleness

    (c) Ductility

    (d) Malleability

    (e) Resilience

6. Draw a stress-strain diagram for ductile material. Discuss the following properties from the diagram : *5×2=10*

    (a) Percentage elongation

    (b) Percentage reduction in area

    (c) Modulus of elasticity

    (d) Modulus of resilience

    (e) Modulus of toughness

7. (a) Two shafts are connected by means of a flange coupling to transmit torque 25 N-m. The flanges of coupling are fastened by four bolts of the same material at a radius of 30 mm. Find the size of bolts, if the allowable shear stress for the bolt material is 30 MPa. 7

    (b) Draw a neat sketch of a screw thread and show the major diameter, minor diameter, pitch diameter, pitch, angle of thread and flank. 3

8. A bracket, made of steel Fe E 200 (Tensile stress = 200 N/mm^2) is subjected to a force of 5 kN acting at an angle of 30° to the vertical. The factor of safety is 4. Determine the dimensions of the cross section of the bracket. *10*
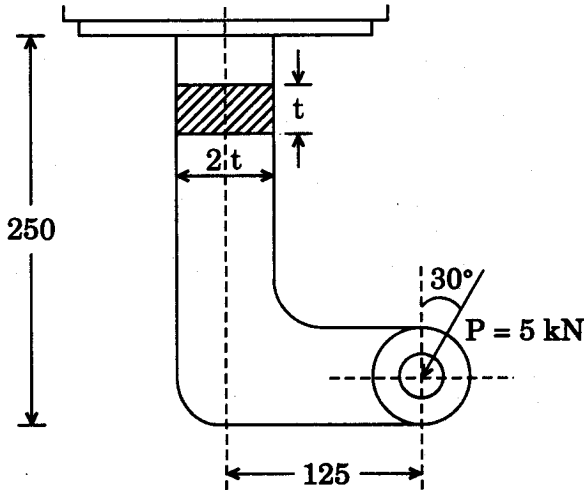
9. (a) Explain in brief the factors for design considerations. *5*

(b) Write the importance of standards in machine design. *5*

10. A flat sunk key is used to connect a pulley to a 40 mm diameter shaft. The standard cross of the key is 12×8 mm. The key and the shaft are made of commercial steel with ultimate tensile strength of 600 N/mm^2. Assume $S_{uc} = 1.25 \, S_{ut}$ and $S_{su} = 0.5 \, S_{ut}$. The torque transmitting capacity of key is same as that of shaft. Determine the length of key, if the factor of safety is 5. *10*

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