BAS-010

B.TECH. (AEROSPACE ENGINEERING) PROGRAMME (BTAE)

Term-End Examination
December, 2011

BAS-010 : MACHINE DESIGN

Time : 3 hours   *Maximum Marks : 70*

Note : (1) *Attempt any seven questions.*

       (2) *Q 1 is compulsory.*

       (3) *Use of scientific calculators is permitted.*

       (4) *Assume any missing data and clearly specify the assumptions.*

1. (a) Which of the following materials has the maximum ductility ?   **10x1=10**

       (i) Mild steel   (ii) Copper

       (iii) Aluminium   (iv) None of these

   (b) In Unilateral system of Tolerance, the Tolerance is allowed on

       (i) One side of the actual size

       (ii) Both sides of the actual size

       (iii) One side of nominal size

       (iv) Both sides of nominal size

(c) The Factor of safety for steel under steady load is

(i) 2   (ii) 4

(iii) 6   (iv) 8

(d) The diameter of the rivet hole is usually _____. The nominal diameter of the rivet.

(i) equal to

(ii) less than

(iii) more than

(e) The electric arc welding is a type of _____ welding.

(i) Forge   (ii) Fusion

(iii) Pressure   (iv) None of these

(f) The washer is generally specified by its.

(i) outer diameter

(ii) hole diameter

(iii) thickness

(iv) mean diameter

(g) The type of stresses developed in the key is/are

(i) Shear stress alone

(ii) Bearing stress alone

(iii) Both shear and Bearing stress

(iv) Shearing, bearing and bending stresses.

(h) In a crossed belt drive, the shafts are arranged parallel and rotate in the _____ direction.

(i) Same   (ii) Opposite

(i) When a helical compression spring is subjected to an axial compressive load, the stress induced in the wire is.

(i) Shear stress

(ii) Compressive stress

(iii) Tensile stress

(iv) Bending stress.

(j) The helix angle for single helical gears ranges from

(i) 10-15 degrees   (ii) 15-20 degrees

(iii) 20-35 degrees   (iv) 35-50 degrees.

2. (a) Draw the stress - strain diagram for the ductile material and show the following points on the curve.   5+5=10

(i) Proportional limit

(ii) Elastic limit
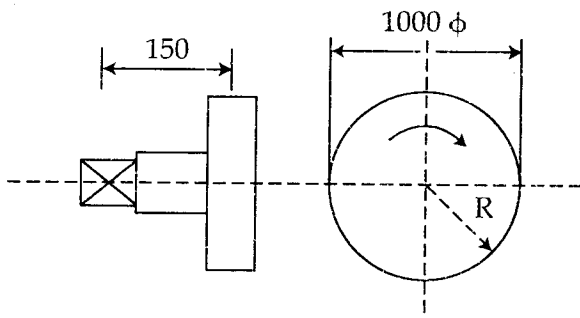
(iii) Upper and lower points

(iv) ultimate strength point

(v) Breaking point.

(b) Draw stress-strain diagram for hard steel which does not exhibit yield point and explain the determination of yield stress by offset method.

3.

150

1000 φ

R

10

A line shaft transmits 25 kW power at 200 rpm by means of a vertical belt drive. The diameter of the belt pulley is 1000 mm and the pulley overhangs 150 mm beyond the centre line of the end bearing. The belt tensions acts vertically downwards. The tension on the tight side of the belt is 2.5 times that on the slack side. The shaft is made of plain carbon steel 40 C 8 (S_{yt} = 380 N/mm^2) and the Factor of safety is 2.5. The mass of the pulley is 25 kg. Determine the diameter of the shaft.

4. (a) Name four materials used for compression springs. **2+8=10**

(b) Design a closed coil helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of Rigidity G = 84 kN/mm^2. Neglect the effect of stress concentration.

5. (a) What do you understand by the following
terms ? 2+8=10

   (i) Through bolt

   (ii) Tap bolt

   (iii) Stud

   (b) Two shafts are connected by means of a
   flange coupling to Transmit Torque of
   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 the
   bolts if the allowable shear stress for the bolt
   material is 30 MPa.

6. Design a Cast Iron Protective type flange coupling **10**
to transmit 15 kW at 900 rpm from an electric
motor to a compressor. The service factor may be
assumed as 1.35. The following permissible
stresses may be used.

   Shear stress for shaft, bolt and key
   material = 40 MPa crushing stress for bolt and
   key = 80 MPa
   Shear stress for cast iron = 8 MPa.
   Draw a neat sketch of the coupling.

7. (a) Explain the Lewis equation for the strength
of Gear Teeth. 3+7=10

(b) A bronze spur pinion rotating at 600 rpm drives a cast iron spur gear at a transmission ratio of 4 : 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the stand-point of strength.

8. (a) Name the types of rivet heads and rivet joints.

2+8=10

(b)
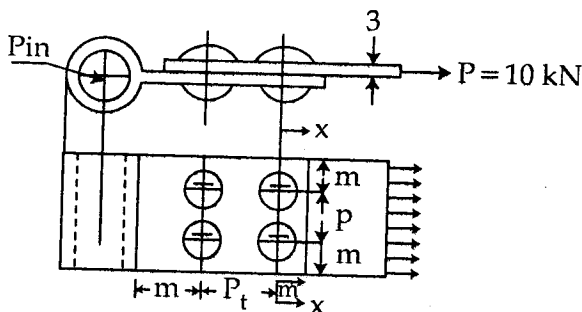
A brake band attached to the hinge by means of a riveted joint is shown in the figure. Determine the size of the rivets needed for the load of 10 kN. Also determine the width of the band. The permissible stresses for the band and rivets in tension, shear and compression are 80, 60, 120 N/mm² respectively. Assume margin (m) = 1.5 d.

9. (a) Mention the types of belts and the materials used for belts. 2+8=10

    (b) An electric motor drives and exhaust fan. Following data are provided.

Data	Motor pulley	Fan Pulley
Diameter	400 mm	1600 mm
Angle of wrap	2.5 radians	3.78 radians
Coefficient of Friction	0.3	0.25
Speed	700 rpm	-
Power transmitted	22.5 kw	.

Calculate the width of 5 mm thick flat belt. Take permissible stress for the belt material as 2.3 MPa.

10. Write short notes on *any four* of the following : 2.5x4=10

    (a) Stress concentration factor

    (b) Different theories of failures

    (c) Selection of preferred sizes

    (d) Plain carbon steels

    (e) Annealing

    (f) Endurance limit.

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