BTS – VI(SS) – 11.13 – 0872

B. Tech. Degree VI Semester Special Supplementary Examination November 2013

ME 603 MACHINE DESIGN I

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 x 5 = 40)

I. (a) State and explain the term 'Resilience'.

(b) Explain the different steps involved in design.

(c) Explain the thread nomenclature with neat sketch.

(d) Obtain the expression for torque required to raise the load by square threaded screws.

(e) Explain the term 'nipping' in a leaf spring with expression.

(f) What is an eccentric riveted joint? Explain the method adopted for designing such a joint.

(g) What are the main advantages and disadvantages of welded joints?

(h) A line shaft rotating at 200 rpm is to transmit 20kW. The shaft may be assumed to be made of MS with an allowable shear stress of 42Mpa. Determine the diameter of the shaft, neglecting the bending moment on the shaft.

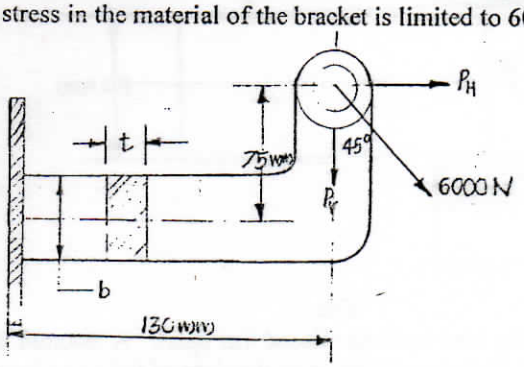
PART B

(4 x 15 = 60)

II. A cylindrical shaft made of steel of yield strength 700Mpa is subjected to static loads consisting of bending moment 10KN-m and a torsional moment 30kN-m. Determine the diameter of the shaft using two different theories of failure, and assuming a factor of safety of 2. Take E = 210 Gpa and Poisson's ratio = 0.25.

OR

III. A mild steel bracket as shown in figure is subjected to a pull of 6000 N acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the Cross-sectional dimensions of the bracket, if the permissible stress in the material of the bracket is limited to 60Mpa.



IV. A vertical two start square threaded screw of a 100mm mean diameter and 20mm pitch supports a vertical load of 18KN. The axial thrust on the screw is taken by a Collar bearing of 250mm outside diameter and 100mm inside diameter. Find the force required at the end of a lever which is 400mm 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 0.2.

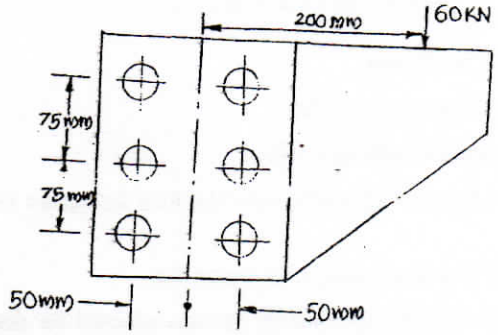
OR

(P.T.O.)

V. Design a gib and cotter joint, to carry a maximum load of 35kN. Assuming that the gib, cotter and rod are of same material and have the following allowable stresses:

$\sigma_t = 20\text{Mpa}$; $\tau = 15\text{Mpa}$; and $\sigma_c = 50\text{Mpa}$

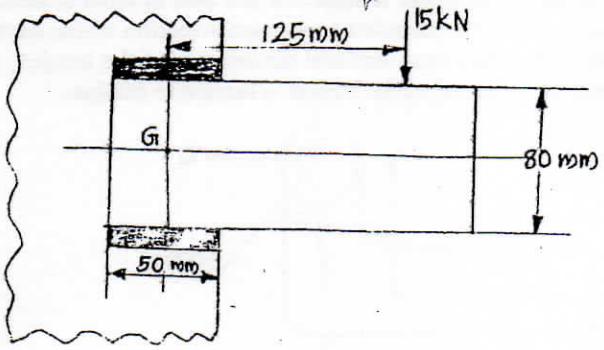
VI. A bracket is riveted to a column by 6 rivets of equal size as shown in figure. It carries a load of 60kN at a distance of 200mm from the centre of the column. If the maximum shear stress in the rivet is limited to 150Mpa, determine the diameter of the rivet.



OR

VII A semi-elliptical laminated vehicle spring to carry a load of 6000N is to consist of seven leaves 65mm wide, two of the leaves extending the full length of the spring. The spring is to be 1.1m in length and attached to the axle by two U-bolts 80mm apart. The bolts hold the central portion of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts. Assume a design stress for spring material as 350Mpa. Determine.
(i) Thickness of leaves (ii) Deflection of spring (iii) Diameter of eye
(iv) Length of leaves and (v) Radius to which leaves should be initially bent.
Sketch the semi-elliptical leaf-spring arrangement. The standard thickness of leaves are: 5, 6, 6.5, 7, 7.5, 8, 9, 10, 11 etc. in mm.

VIII. A bracket carrying a load of 15kN is to be welded as shown in figure. Find the size of weld required if the allowable shear stress is not to exceed 80Mpa.



OR

IX. A shaft is supported by two bearings placed 1m apart. A 600mm diameter pulley is mounted at a distance of 300mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400mm diameter is placed 200mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63Mpa in tension and 42Mpa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley.