B.Tech Degree VI Semester (Supplementary) Examination September 2011

ME 603 MACHINE DESIGN I

(2006 Scheme)

(use of approved data book permitted)

Time: 3 Hours Maximum Marks: 100

PART A

(Answer ALL questions)

(8 × 5 = 40)

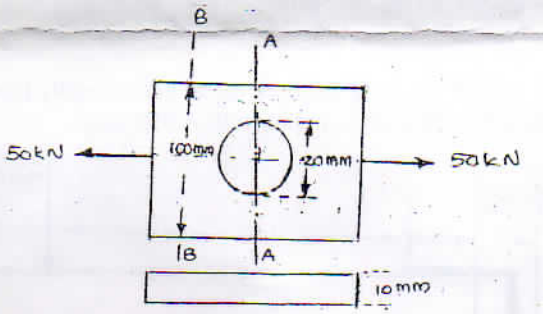
I. (a) List out and explain the mechanical properties of materials.
(b) State and explain the term 'Resilience'.
(c) With neat sketch explain the thread nomenclature.
(d) State the merits and demerits of splined joints over key joints.
(e) Explain how the efficiency of a riveted joint is determined.
(f) Obtain the expression for deflection for a cylindrical helical spring with axial loading.
(g) State the assumptions made in design of welded joints. Justify the assumptions.
(h) Is a hollow shaft stronger or weaker than a solid shaft of same weight? Validate your answer.

PART B

(4 x 15 = 60)

II. (a) A cylindrical rough machined member made from C-50 steel of 50mm is reduced to 30mm diameter by a 5mm fillet. It is subjected to light shock load producing a completely reversed stress in bending and the life is estimated to be 10 million cycles. Find the bending moment. Take FOS = 1.5, $\sigma_y = 373\,\text{MPa}$, $\sigma_{en} = 317\,\text{MPa}$. (8)

(b) A tension member is loaded as shown in figure given below.



Determine

(i) nominal stress at section AA and section BB
(ii) stress concentration factor
(iii) maximum stress at section AA
(iv) factor of safety, if the material used is C-25 steel.
(v) If factor of safety is 2, suggest the material. (7)

OR

III. (a) An unknown weight falls through 10mm on a collar rigidly attached to the lower end of a vertical bar 3m long and 600mm^2 in section. If the maximum instantaneous extension is known to be 2mm, what is the corresponding stress and the value of unknown weight. Take $E = 2 \times 10^5\,\text{N/mm}^2$. (7)

(b) A mild steel shaft of 5cm diameter is subjected to a bending moment of 2000Ncm. If the yield point of steel in tension is 200N/cm^2, find the maximum value of torque without causing yielding to the shaft according to

(i) maximum principal stress theory
(ii) maximum shear stress theory
(iii) maximum distortion energy theory (8)

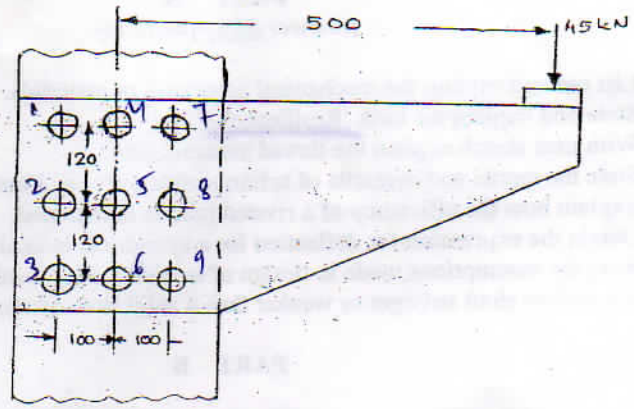
IV. Design and sketch a gib and cotter joint to resist safely a tensile load of 40kN. The material of the gib, cotter and rods is same for which the allowable safe stresses are $\sigma_c = 60\,\text{N/mm}^2$, $\sigma_t = 25\,\text{N/mm}^2$ and $\sigma_s = 20\,\text{N/mm}^2$. (15)

OR

(P.T.O.)

V. An eye is forged at one end of the half of the tie rod and a fork at the end of other half. Knuckle pin is passed through the holes of the fork and the eye. The pull in the tie rod is 150kN. Allowable stresses in tension and shear are 65 N/mm^2 and 30 N/mm^2 respectively. Take the allowable bearing pressure on the pin as 10 N/mm^2. Design the joint completely. Make a dimensioned sketch of the joint. (15)

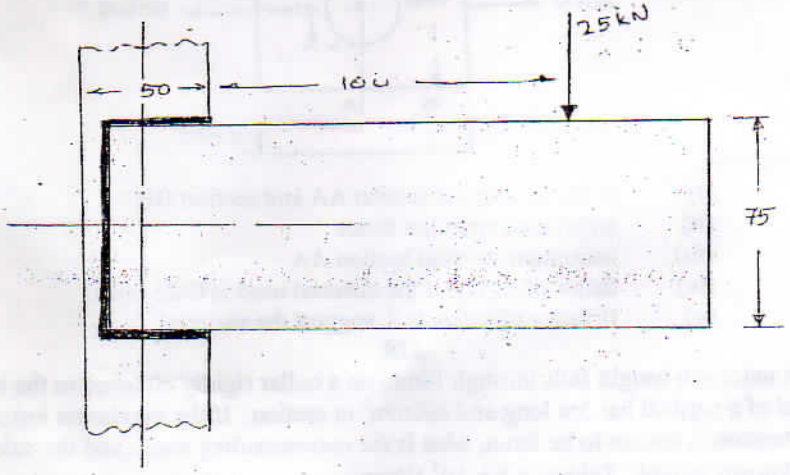
VI. The bracket shown in figure is to carry a load of 45kN at an eccentricity of 0.5m from the centroid of the rivet group. If the rivets are of 16mm in diameter, what is the maximum shearing stress induced in the rivets. Also find the bearing stress induced in rivets, if the thickness of the plate is 10mm. (15)



OR

VII. A semi elliptical laminated spring is to carry a load of 5kN and consists 8 leaves 46mm wide, two of the leaves being full length. The spring is to be made 1000mm between the eyes and is held at the center by a 60mm wide band. Assume that the spring is initially stressed so as to induce an equal stress of 500N/mm^2 when fully loaded. Design the spring. Assume E = 2.1× 10^5 N/mm^2. (15)

VIII. Calculate the size of the weld required for an eccentrically loaded weld as shown in figure. The allowable stress in the weld is 75N/mm^2. (15)



OR

IX. (a) A machinery shaft supported on bearings 2.4m apart to transmit 187.5 KW at 200rpm. It is subjected to a bending load of 5KN located at a distance of 0.66m from one bearing. Safe stress in shear is 42 MPa and in bending 84 MPa.

(i) Determine the shaft diameter for steady loading

(ii) Determine the shaft diameter for if the transverse load is steady and the torsional load is suddenly applied. (10)

(b) Explain whirling speed of shaft. (5)

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