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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: ME401

Course Name: DESIGN OF MACHINE ELEMENTS - I

Max. Marks: 100 Duration: 3 Hours

(i) Use of approved design data book is permitted

(ii) Missing data if any may be suitable assumed

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) What do you mean by preferred numbers? Explain with the help of an example. (5)

b) Define the term notch sensitivity. Establish the relationship between notch sensitivity and fatigue stress concentration factor. (5)

c) Distinguish between ductile and brittle materials with the help of a stress- strain diagram? (5)

2 a) A cantilever beam of square section supports an electric motor weighing 1000 N at a distance of 400 mm from the fixed end. If the allowable stress of beam material is 100 N/mm^2, Determine section of beam. (5)

b) A mild steel shaft is subjected to a 3500 N-m of bending moment at its critical point and transmits a torque of 2500 N-m. The shaft is made of steel having a yield stress of 230 MPa. Estimate the size of the shaft (FOS =2) based on following theories of failure (10)

1. Maximum normal stress theory
2. Maximum shear stress theory
3. Distortion energy theory

3 a) What are the factors affecting the endurance strength? (3)

b) Explain the procedure for the design of a component for finite life under varying amplitude loading? (4)

c) A steel shaft is subjected to a torque that varies over a range of +/- 40%. Determine the diameter of the shaft if it transmits 14 kW at 225 rpm. The material has a ultimate tensile strength of 600 MPa and yield strength of 400 MPa. FOS =3. (8)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Show by neat sketches the various modes of failure of riveted joint? (5)

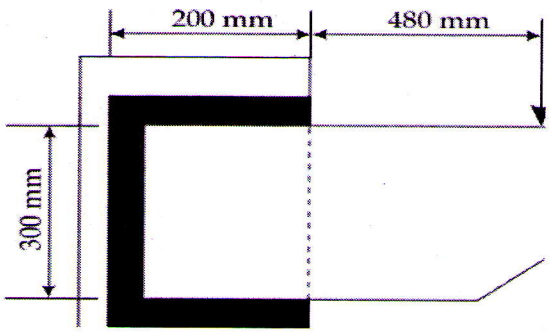
b) Two lengths of mild steel rods having width 200 mm and thickness 12.5 mm are connected with a butt joint with equal width straps. Design lozenge joint if the permissible working stress in plate and rivet material are 80 N/mm^2 in tension 50 N/mm^2 in shear and 150 N/mm^2 in crushing. (10)

5 a) What is meant by pre-tension in bolts? What is its significance? (5)

b) The cylinder head is fastened to the cylinder of a compressor using 6 bolts (steel C 20) of M20 size. The maximum fluid pressure is 3.2 MPa, cylinder diameter is 70 mm. A soft copper gasket is used. Assume the initial tension required in each bolt as 40kN, Determine the factor of safety? (10)

6 a) Why do we design the weld joints based on throat area? (3)

b) Determine the size of the weld for a bracket loaded as shown in the figure. The allowable stress in the weld as 60 MPa . (12)



PART C

Answer any two full questions, each carries 20 marks.

7 a) Why do we consider Wahl's factor for the design of helical compression springs? (4)

b) What is surging in springs? (4)

c) A spring is subjected to a variable load varying from 500 N to 900 N. Determine diameter of wire and mean diameter of coils. Yield strength in shear 750 MPa, torsional fatigue strength 350 MPa. (12)

8 a) Differentiate between torsional rigidity and lateral rigidity of shaft. (5)

b) A solid steel shaft of 500 mm long between bearings 'A' and 'C' and carrying a (15)

cast iron pulley at 'B' which is at 300 mm from the bearing 'A'. The pulley is directly coupled to a 5 kW motor running at 750 rpm. The motor is located left side of the bearing 'A'. The cast iron pulley is of 250 mm in diameter and weighing 100 N and is driving a machine shaft running below it. The belt from pulley to the machine is inclined 60° to the vertical. Determine the appropriate diameter of the shaft, assuming moderate shock conditions, the friction factor between the pulley and the belt as 0.3, factor of safety 4.0.

9 a) Prove that compressive stress induced in square key is twice that of shear stress (5)

b) Design a protected type CI flange coupling for a steel shaft transmitting 28 kW at 200 rpm. The allowable shear stress in the shaft and key material is 40 MPa. The maximum torque transmitted is to be 20% greater than the mean torque. The allowable shear stress in the bolt is 60 MPa and allowable shear stress in CI flange is 40 MPa (15)

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