Common to Industrial and Manufacturing Engineering Branch

Fourth SEMESTER – (REGULATION 2008)

ME 9261–MACHINE DESIGN

Use of approved design data book permitted.

Time : 3 hr.   Max. Mark :100

Answer ALL Questions

Part A (10 x 2 = 20 Marks)

1   What are the factors that govern selection of materials while designing a machine component?

2   How is factor of safety defined for brittle and ductile materials?

3   Differentiate between Endurance limit and endurance strength..

4   What are the methods used to improve fatigue strength?

5   What are the requirements of spring while designing?

6   What is material used for flange or flange couplings?

7   What stresses act on screw fastening?

8   What is a 'bearing characteristic number'?

9   Define 'coefficient of fluctuation of speed' in a flywheel

10   Explain the principle of hydrodynamic lubrication.

PART B (5 x 16 = 80 Marks)

11   The shaft as shown in figure below is driven by pulley B from an electric motor. Another belt drive from pulley A is running the compressor. The belt tensions for the pulley A are 1500N and 600N. The ratio of belt tensions for pulley B is 3.5. Diameter of pulley A is 150mm and diameter of pulley B is 480mm. The allowable tensile stress for the shaft material is 170MPa and allowable shear stress is 85MPa. Taking bending and torsion factors as 1.25 and 1.75 respectively, find the shaft diameter.

All dimensions in mm.

(16)
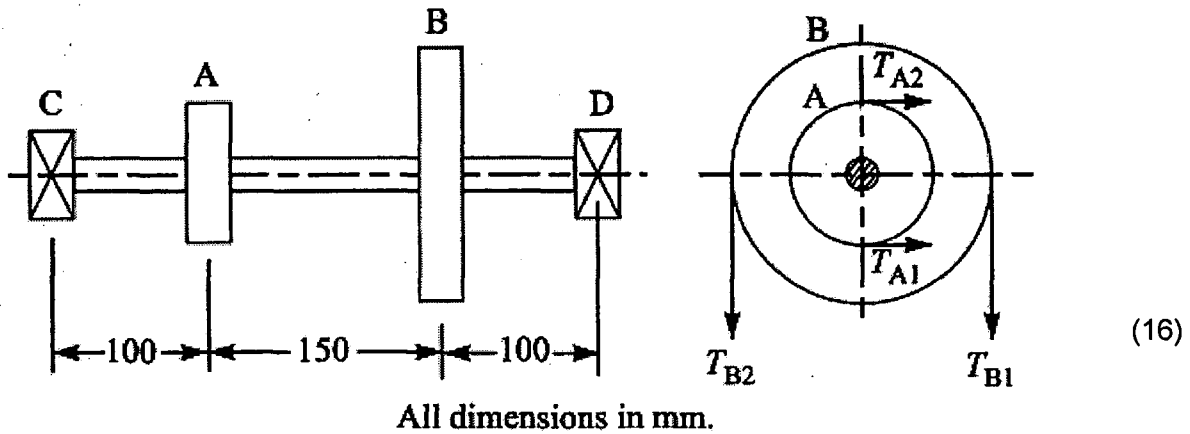
12a A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20kN and a maximum value of 50kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by: Ultimate strength of 650 MPa, Yield strength of 500 MPa and endurance strength of 350MPa.

(16)

[OR]

12b A mild steel of shaft of 50mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to Maximum shear stress theory and maximum distortion strain energy theory of yielding.

(6)

13a A knuckle joint is to transmit a force of 200kN. Allowable stresses in tension, shear and compression are 75N/mm^2, 65 N/mm^2 and 140 N/mm^2 respectively. Design the joint.

(16)

[OR]

13b (i) The head of the steam cylinder of 600mm diameter is subjected to steam pressure of 1.3N/mm^2 The head is held in place by 16 bolts of M36 size. A soft copper gasket is used to make the joint steam tight. Determine the stress (8) induced in the bolts.

(ii) A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in the figure below. Determine the weld size if shear stress in the same is not to exceed 140 MPa. (8)

Weld — P = 60 kN

100

50 ← 150 →
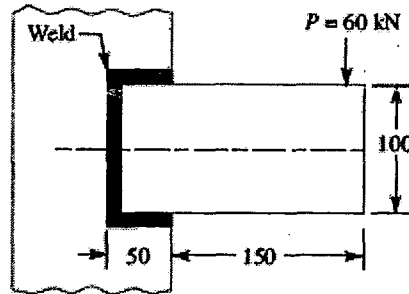
14a A closely coil helical spring is made of 10mm diameter steel wire, the coil consisting of 10 complete turns with a mean diameter of 120mm.The springs carries an axial pull of 200N. Determine also deflection in the spring, its stiffness and strain energy stored by it if the modulus of rigidity of the material is 80KN/mm^2. (16)

[OR]

14b A single cylinder double acting steam delivers 185KW at 100rpm.The maximum fluctuation of energy per revolution is 15 percent of the energy developed per revolution. The speed variation is limited to 1percent either way from the mean. The mean diameter of the rim is 2.4m. Design and draws two views of the flywheel. (16)

15a A journal bearing is proposed for a steam engine. The load on the journal is 3kN, diameter 50 mm, length 75 mm, speed 1600 rpm, diametral clearance 0.001 mm, ambient temperature 15.5 degree centigrade. Oil SAE 10 is used and the film

temperature is 60 degree centigrade. Determine the heat generated and heat dissipated. (16)

[OR]

15b Design a connecting rod for a petrol engine for the following data:

Diameter of the piston = 68 mm

Stroke length = 80 mm

Length of connecting rod = 160 mm

Maximum explosion pressure = 3.5 N/ mm^2

Mass of reciprocating parts = 2.5 kg

Speed = 4000 rpm

Compression ratio = 8 :1 (16)