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06ME61

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

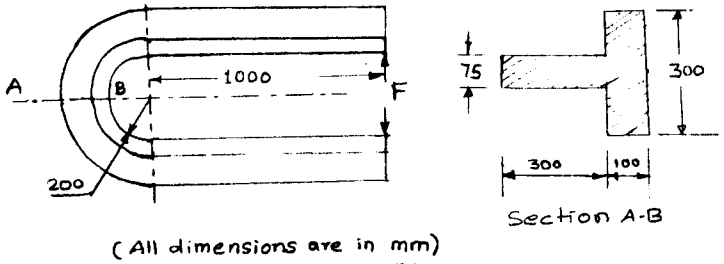
Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Use of Design data handbook is permitted.
3. Suitable data may be assumed wherever necessary.

2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice

PART – A

1 a. Distinguish between a straight beam and a curved beam. Sketch the distribution of stresses in both the beams. **(06 Marks)**

b. The 'T' section frame of a punch press is shown in Fig.Q1(b). Determine the safe load 'F' that the frame of punch press can carry, if the maximum stress in the frame is not to exceed 120 MPa. **(14 Marks)**



(All dimensions are in mm)

Fig.Q1(b)

2 a. Derive Lame's equation for a thick cylinder. **(10 Marks)**

b. A circular cylinder is provided with a flat circular steel plate of 500 mm diameter and is supported around the edge. It is subjected to a uniform pressure of 7 N/mm^2. The allowable working stress for the material is 80 N/mm^2 and Poisson's ratio is 0.3. Determine the thickness of the cylinder wall and cylinder head. **(10 Marks)**

3 a. It is required to design a helical compression spring subjected to a maximum load of 1250 N. The deflection of the spring corresponding to the maximum load should be 30 mm. The spring index is 6. The spring wire is made of patented and cold drawn steel wire. The ultimate tensile strength and modulus of rigidity are 1090 N/mm^2 and 82.7 × 10^3 N/mm^2 respectively. The permissible shear stress for the spring wire should be taken as 50% of ultimate tensile strength. Design the spring. Assume square and ground ends. **(12 Marks)**

b. Design a cantilever spring of 0.6 m, length to absorb 800 N-m of energy with a deflection of 0.1 m. The permissible stress in the leaves is 600 MPa. Take total number of leaves as 10. The modulus of elasticity of leaf material is 206.8 GPa. **(08 Marks)**

4 A pinion made of carbon steel having a tensile strength of 600 MPa is meshing with a steel gear having tensile strength of 400 MPa. The pinion is driven by a reversible motor having a speed of 1400 rpm and 10 kW rating. The speed ratio is 2.15. Use a service factor of 2 and a factor of safety 3. Design 20° full depth involute spur gear. Specify the hardness of the gear. **(20 Marks)**

PART – B

5 A pair of right angled bevel gear wheels made up of steel with 20° pressure angle consists of 20 teeth pinion meshing with 30 teeth gear. The module is 4 mm while face width is 20 mm. The surface hardness of both pinion and gear is 400 BHN. The pinion rotates at 500 rpm and receives power from an electrical motor. The starting torque of the motor is 50% more than the rated torque. Determine the power of the motor by considering the dynamic load, wear strength and endurance strength. The allowable bending stress may be taken as 240 MPa. **(20 Marks)**

6 a. A cone clutch with asbestos friction lining transmits 30 kW power at 500 rpm. The coefficient of friction is 0.2 and permissible intensity of pressure is 0.35 N/mm^2. The semicone angle is 12.5°. Calculate : (i) The inner diameter (ii) Face width of friction lining (iii) Force requires to engage the clutch. **(10 Marks)**

b. A single block brake with a torque capacity of 250 N-m is shown in Fig.Q6(b). The brake drum rotates in CW direction 100 rpm. The coefficient of friction is 0.35. Calculate:

(i) Actuating force (ii) Tangential friction force
(iii) Normal force on the shoe (iv) Resultant hinge pin reaction
(v) Heat generated. **(10 Marks)**

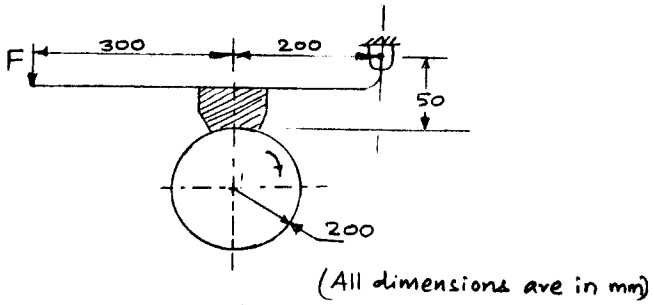


Fig.Q6(b)

7 a. Explain different types of lubrication mechanisms. **(06 Marks)**

b. Following data refer to a 360° hydrodynamic bearing:

Radial load = 3.2 kN Journal speed = 1490 rpm
Journal diameter = 50 mm Bearing length = 50 mm
Radial clearance = 0.05 mm Oil viscosity = 25 cp.
Determine : (i) Coefficient of friction (ii) Power lost due to friction
(iii) Minimum film thickness (iv) Flow rate
(v) Change in temperature (v) Maximum film pressure **(14 Marks)**

8 a. A transmission shaft rotating at 400 rpm drives a machine by a flat belt drive, which requires 40 kW at 800 rpm. A 300 mm diameter cast iron pulley is located on the transmission shaft. The mass density of belt material is 980 kg/m^3. The allowable stress in belt is 2 MPa and the two pulleys rotate in opposite directions. The centre distance between the shafts is 800 mm and the coefficient of friction is 0.3 for both pulleys. Determine (i) Diameter of smaller pulley (ii) Stress on slack side (iii) Required cross sectional area of the belt. **(10 Marks)**

b. Select a V-belt for transmitting a power of 6 kW from a shaft rotating at 1500 rpm to another shaft to run at 400 rpm. **(10 Marks)**

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