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06ME61

Sixth Semester B.E. Degree Examination, June/July 2017

Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of design data handbook is permitted.***
3. ***Missing data, if any, may suitably be assumed.***

PART – A

1 a. Define a curved beam and mention its applications. Also differentiate between a straight beam and a curved beam. **(06 Marks)**

b. A crane hook of trapezoidal cross section whose inner and outer sides are 60 mm and 30 mm has a depth of 64 mm. The centre of curvature is at a distance of 90 mm from the inside of the beam. Determine the maximum tensile, compressive and shear stresses induced in the crane hook when its lifting capacity is 60 kN. **(14 Marks)**

2 a. With reference to pressure vessels, what is autofrettage? Explain in brief. **(04 Marks)**

b. Calculate the thickness of a cylindrical shell of internal diameter 200 mm which is required to withstand a fluid pressure of 50 MPa. Assume the permissible circumferential stress as 200 MPa. **(10 Marks)**

c. A hydraulic cylinder used in a fork lift is made of cast iron. The piston rod exerts an operating force of 20 kN. The pressure inside the cylinder is 15 MPa. Taking the allowable stress of cast iron as 50 MPa and frictional forces as 10% of the operating force, determine the diameter and thickness of hydraulic cylinder. **(06 Marks)**

3 a. Derive an expression for the stress induced in a helical coil spring. **(05 Marks)**

b. What is surging in spring and how it can be overcome? **(03 Marks)**

c. A semi elliptical laminated leaf spring with two full length leaves, ten graduated leaves are to be designed to support a central load of 6 kN over two points 1 metre apart. The central band width is 100 mm. The ratio of total depth of the spring to its width is 2.5. The design normal stress of the material of the leaves is 400 MPa and the modulus of elasticity is 208 GPa. Determine:
i) Width and thickness of leaves
ii) The initial gap between full length and graduated leaves
iii) The central bolt load. **(12 Marks)**

4 a. Write a note on helical gears. **(03 Marks)**

b. Design of a pair of spur gears to transmit 20 kW of power while operating for 8 to 10 hrs per day sustaining medium shock, from a shaft rotating at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Assume the number of teeth on pinion to be 31 and 20° full depth involute tooth profile. The material for pinion is C40 steel, untreated whose σ_b = 206.81 MPa and for gear is cast steel, 0.2% c, untreated whose σ_b = 137.34 MPa. Check the design for wear and dynamic load. Assume the dynamic load factor, c = 522.464 and load stress factor, k = 0.279. Suggest suitable hardness. **(17 Marks)**

PART – B

5 a. Mention the advantages and disadvantages of worm gear drive. **(04 Marks)**

b. Design a pair of right angle bevel gears to transmit 8.5 kW at 1500 rpm of pinion. The velocity ratio is 5:1. Pinion is made of cast steel and gear of high grade cast iron with allowable static stresses as 120 MPa and 93 MPa respectively. The teeth are 20° stub involute, pinion has a pitch diameter of 90 mm. **(16 Marks)**

6 a. Design a cone clutch to transmit a power of 40 kW at a rated speed of 750 rpm. Also, determine:

i) Axial force necessary to transmit torque.

ii) Axial force necessary to engage the cone clutch.

Assume coefficient of friction = 0.3, cone angle = 20°. **(10 Marks)**

b. A single band brake operates on a drum 600 mm in diameter that is running at 200 rpm while absorbing 15 kW of power. The coefficient of friction is 0.25. The brake band has a contact of 270° and one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight arm is 750 mm long and is placed perpendicular to the diameter that bisects the angle of contact. Determine the maximum effort required to stop the rotation of drum. **(06 Marks)**

c. Classify the brakes and name different types of mechanical brakes. **(04 Marks)**

7 a. Derive Petroff's equation, with usual notations. **(08 Marks)**

b. It is required to design a main bearing of a four stroke oil engine to sustain a load of 6 kN over a shaft of diameter 50 mm. The operating speed if the shaft is 1000 rpm and operating temperature is 50°C. Assuming absolute viscocity as 33 centipoise, determine:

i) Length of the bearing

ii) Coefficient of friction

iii) Heat generated

iv) Heat dissipated

v) Amount of heat to be removed by artificial cooling, if necessary and

vi) Sommerfeld number. **(12 Marks)**

8 a. Two shafts 1 m apart are connected by a V-belt to transmit 90 kW at 1200 rpm of a driver pulley of 300 mm diameter. The driver pulley rotates at 400 rpm. The angle of groove is 40° and the coefficient of friction between the belt and the pulley rim is 0.25, the area of the belt is 400 mm^2 and the permissible stress is 2.1 MPa. Density of the belt material is 1100 kg/m^3 Calculate the number of belts required and the belt length. **(10 Marks)**

b. A 6 × 19 wire rope is used to lift a load of 10 kN of iron ore from a mine of 600 mm deep. The weight of the bucket is 2 kN. The maximum speed of 50 m/min is attained in/second Find the diameter of the wire rope, assuming factor of sabets as 6. **(10 Marks)**

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