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10ME62

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.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 hand book is permitted.

PART – A

1 a. Crane hook of trapezoidal cross-section with an inner side of 120mm and outer side of 60mm. The depth of the section is 90mm. The centre of curvature is at a distance of 120mm from the inner edge of the section and the line of action of load is at a distance of 135mm from the inner edge. Determine the safe load that the hook can carry if it is made of steel having an allowable stress of 90 MPa. **(10 Marks)**

b. A 100mm inside and 150mm outside sleeve is press fitted on to a shaft of 100mm diameter? The modulus of elasticity of material is 210 GPa and Poisson ratio is 0.28. The contact pressure is not to exceed 60 MPa. Determine:
i) Tangential stress at inner and outer surface of the sleeve and outside diameter of the shaft.
ii) The radial stresses in the sleeve and shaft.
iii) The original diameters of the shaft and hub before press fit.
iv) The total interference. **(10 Marks)**

2 a. For a flat belt drive, the following data are given power transmitted = 9kW, speed of motor = 1500rpm, speed of driven pulley = 500 rpm, velocity of belt 16 m/sec, load factor = 1.2, density of leather = 9.8 kN/m^3. Small diameter to thickness of belt ratio = 36, factor of safety = 10, ultimate strength of belt material = 24 MPa, centre distance = 2.1m, coefficient of friction = 0.36. Design the belt. **(10 Marks)**

b. Select a r-belt drive to transmit 9 kW from a shaft rotating at 1200rpm to a parallel shaft to run at 300rpm. The diameter of smaller pulley is 120mm. The centre distance between shafts is 1.2m. **(10 Marks)**

3 a. Design a rectangular section helical spring to mount a buffer to sustain a load of 30kN. The deflection under load is 90mm. The spring is made of Z-nickel having a torsional ultimate stress of 830 MPa. The longer side of rectangle is twice the shorter side and the spring is wound with longer side of rectangle parallel to the axis. The spring index is 10. Take factor of safety = 2.5 and G = 75.51 GPa. **(12 Marks)**

b. A laminated spring having 6 graduated leaves is simply supported at ends at a distance of 0.9m. It is made of steel having allowable bending stress of 360 MPa. The width and thickness of leaves are 90mm and 6mm. Find the safe load that can be carried by this spring at the middle and the deflection under that load. Take $\in$ = 206 GPa. **(08 Marks)**

4 Design a pair of steel spur gears required to transmit 12kW at 2000 rpm of pinion. The velocity ratio received is 2.5:1. The allowable static stress for both may be taken as 138 MPa. Not less than 24 teeth are to be used on either gear. The teeth are 20° stub teeth. **(20 Marks)**

PART – B

5 Two shafts inclined at 60° are connected by a pair of bevel gears to transmit 9kW at 900rpm of 24 tooth cast steel pinion having allowable static stress of 138 MPa. The gear is made of high grade CI having allowable static stress of 103 MPa and is to run at 300rpm. The teeth are 14 ½° involute form. Design the gears completely. **(20 Marks)**

6 a. A multiplate clutch consists of 5 steel and 4 bronze plates. The inner and outer diameters of friction discs are 75mm and 150mm respectively. The coefficient of friction is 0.1 and allowable pressure is to be limited to 0.3 MPa. Assuming uniform pressure. Calculate:
i) The required axial force.
ii) Power that can be transmitted at 750 rpm. **(10 Marks)**

b. A 360mm radius brake drum contacts a single shoe as shown in Fig.Q.6(b) and sustains a power of 23.5 kW at 1000 rpm. Determine:
i) The normal force F_n on the shoe.
ii) The tangential force.
iii) The operating force for clockwise rotation.
iv) The value of distance 'C' for the brake to be self locking and
v) The rate of heat generated. **(10 Marks)**

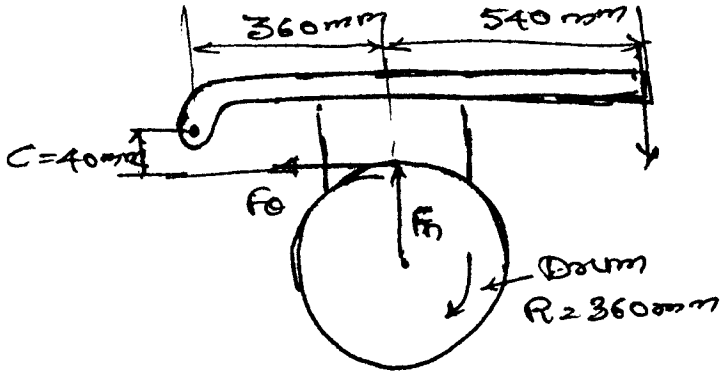

Fig.Q.6(b)

7 a. Derive the Petroff's equation for coefficient of friction. **(08 Marks)**

b. A full journal bearing 90mm diameter and 150mm long has a radial load of 2MPa per unit projected area. Shaft speed is 500rpm. The bearing is operating with SAE 20 oil at 50°C. The specific gravity of oil at the operating temperature is 0.985. Calculate the following:
i) Minimum film thickness
ii) Heat lost due to friction
iii) Whether artificial cooling is necessary. **(12 Marks)**

8 Design a cast iron piston for a single acting four stroke engine for the following data: Cylinder bore: 100mm, stroke = 125mm, maximum gas pressure = 5 N/mm^2, indicated mean effective pressure = 0.75 N/mm^2, mechanical efficiency = 80%, fuel consumption = 0.15 kg, per brake power per hour, higher calorific value of fuel = 42 × 10^3 kJ/kg, speed = 2000 rpm. **(20 Marks)**

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