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10AU63

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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 machine design data hand books permitted.***
3. ***Missing data may be suitably assumed.***

PART – A

1 a. List the differences between straight beam and curved beams. **(04 Marks)**

b. A crane hook of rectangular section of size 150mm × 75mm is to carry a load of 100 KN. The distance of inner fibre is 100 mm from the centre of curvature. Determine the values of maximum tensile and shear stresses and also their locations. **(16 Marks)**

2 a. Calculate the thickness of a cylindrical shell of internal diameter 250 mm required to withstand a fluid pressure of 50 N/mm^2 assuming the permissible circumferential stress as 180 N/mm^2. **(10 Marks)**

b. The cylinder head of a steam engine is held in position by 10 bolts. The diameter of cylinder is 400 mm and the maximum pressure of steam in cylinder is 1 MPa. A copper Gasket is used to make the joint leak proof. Determine the standard size of bolts required by taking the design tensile stress for bolt material as 90 MPa. **(10 Marks)**

3 a. Derive expressions for stress and deflections of helical spring. **(10 Marks)**

b. A semi elliptical spring is 1 meter long and is to support a load of 50 kN. The spring has 15 leaves out of which 3 are full length leaves. The width of central band is 100 mm. All the leaves are to be stressed to 400 MPa. The ratio of total depth to width of plates is 3. Taking E = 210 GPa, determine,

(i) The width and thickness of leaves.
(ii) The initial gap that should be provided between full length and graduated leaves before assembly.
(iii) The load exerted on band after assembly. **(10 Marks)**

4 a. In a simple band brake used on a brake drum of 600 mm diameter, one end of band is attached to the fulcrum while the other end is attached to the lever at a distance of 600 mm from the fulcrum on the lever which is 1200 mm long. The brake is to absorb 10 kW at 1000 rpm of drum. Taking $\mu = 0.3$, determine

(i) The minimum effort required to operate brake.
(ii) The area of cross section of band assuming 40C8 as material of band. Use factor of safety 4.
(iii) The dimensions of rectangular cross section of lever taking depth equal to thrice width and material of lever same as that of band. **(12 Marks)**

b. A multidisc clutch is required to transmit 25 kW at 1400 rpm. The maximum and minimum diameters of discs are 300 mm and 100 mm respectively. Taking $\mu = 0.2$, pressure between contact surfaces as 0.08 MPa, determine

(i) The axial force required to engage clutch.
(ii) The number of friction surfaces and
(iii) The number of discs on driver and driven shafts.

Assume uniform wear theory **(08 Marks)**

PART – B

5 a. Explain design for, (i) Largest number of teeth (ii) Smallest pitch diameter. **(03 Marks)**

b. Design a pair of cast iron spur gears to transmit 15 kW at 1440 rpm of pinion. The desired transmission ratio is 5 : 1. The centre distance between shafts should be very close to 400 mm. **(17 Marks)**

6 Design a pair of right angle bevel gears to transmit 10 kW at 1200 rpm of pinion. The gear is to run at 420 rpm. The pinion is made of steel and gear of cast iron. The number of teeth on pinion is 21 and gear teeth are of 14.5 Deg involute profile. **(20 Marks)**

7 a. A 75 mm long journal bearing of diameter 75 mm supports a radial load of 12 kN at shaft speed of 1800 rpm. Assume ratio of diameter to diametral clearance as 1000. The viscosity of oil is 0.01 PaS at the operating temperature. Determine

(i) Sommerfeld number.

(ii) μ based on Mckee's equation.

(iii) Amount of heat generated. **(10 Marks)**

b. A single row ball bearing is to carry an axial load of 2 kN and radial load of 3 kN. The service imposes light shock and the bearing will be in use for 3 years at 10 hours/day. Taking speed of shaft equal to 1200 rpm, select suitable medium series SKF ball bearings. **(10 Marks)**

8 a. Prove that the power transmitted in belt is maximum when the maximum tension in belt is 3 times the centrifugal tension (i.e. $T_{max} = 3T_C$). **(08 Marks)**

b. Select a V-belt drive to transmit 8 kW from a shaft running at 1000 rpm to a parallel shaft to be run at 400 rpm. Limit the pitch diameter of smaller pulley (smaller sheave) to 150 mm. **(12 Marks)**

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