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06ME61

Sixth Semester B.E. Degree Examination, December 2011
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 machine data hand book is permitted.

PART – A

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

b. The cross section of a steel crane hook is a trapezium with an inner side of 50 mm and outer side of 25 mm. The depth of the section is 64 mm. The centre of curvature of the section is at a distance of 64 mm from the inner edge of the section and the line of action of load is 50 mm from the same edge. Determine the maximum load the hook can carry if the allowable strength is limited to 60 MPa. **(16 Marks)**

2 a. Design a helical compression spring to sustain an axial load that fluctuates between 1.5 kN and 2 kN with an associated deflection of 15 mm during the fluctuation of load. **(10 Marks)**

b. An automotive leaf spring is to be designed to consist of 10 graduated leaves and 2 full length leaves. The spring is to support a central load of 5 kN over a span of 1100 mm with the actual band with of 100 mm. The width and thickness of leaves limiting the maximum equalized stress induced in the leaves to 350 MPa. Also determine the initial gap to be provided between the full length and graduated leaves before the assembly. **(10 Marks)**

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

b. A circular plate made of steel and of diameter 200 mm with thickness 10 mm is subjected to a load inducing a pressure of 4 MPa. Taking E = 201 kN /mm^2, Poisson's ratio = 0.3, determine :

i) The maximum stress, its location and maximum deflection when the edges of the plate are supported

ii) The maximum stress, its location and maximum deflection when the edge of the plate is fixed. **(10 Marks)**

4 a. Derive the Lewis equation for the beam strength of a gear tooth. Also list the assumptions. **(04 Marks)**

b. Design a pair of spur gears to transmit 20 kW of power at a pinion speed of 1000 rpm. The required velocity ratio is 3.5 : 1. 20° stub involutes tooth profile to be used. The static design stress for the pinion is 100 MPa and for the gear is 70 MPa. The pinion has 16 teeth. Determine the module, face width, and pitch circle diameters of the gears based on a service factor is 1.25. **(16 Marks)**

PART – B

5 a. Explain with a sketch, the formulative number of teeth based on bevel gears. **(04 Marks)**

b. A pump is driven by a 30 kW motor through a pair of right angled bevel gear. The speed of the motor is 1200 rpm. The pinion on the motor has a pitch circle diameter of 150 mm and carries 30 teeth and the gear on the pump shaft carries 40 teeth. The pinion made of C_{45} steel untreated where as the gear is made of 0.2 % carbon steel untreated. The teeth are generated to have 20° full depth involute. Check whether the gear pair is safe from the stand point of bending strength. **(16 Marks)**

6 a. A multiple clutch as steel on bronze is to transmit 8 kW at 1440 rpm. The inner diameter of the contact is 80 mm and the outer dia of contact is 140 mm. The clutch operates in oil with expected co–efficient of friction of 0.1, the average allowable pressure is 0.35 MPa. Assume uniform wear theory and determine the following :

i) No. of steel and bronze plates
ii) Axial force required
iii) Actual maximum pressure. **(10 Marks)**

b. A friction cone clutch has to transmit a torque of 200 N/m at 1440 rpm. The large diameter of the cone is 350 mm, the cone pitch angle is 6.25°. The face width is 65 mm. The co–efficient of friction is 0.2. Determine :

i) The axial force required to transmit the torque
ii) The average normal pressure on the contact surface with the maximum torque is transmitted. **(10 Marks)**

7 a. Discuss the mechanism of fluid film lubrication. **(04 Marks)**

b. Design a journal bearing to withstand a load of 5886 N. speed of the journal is 1000 rpm. The journal is made of hardened steel and bearing is made of babbit. Operating temperature is 70°C and ambient temperature is 30°C. Check the design for thermal equilibrium and also determine the power loss at the bearing. The lubricant used is of grade SAE 40 $\ell/d = 1.5$. **(16 Marks)**

8 a. Select a V belt drive to transmit a power of 6 kW from a shaft rotating at 1500 rpm to a parallel shaft to be run at 375 rpm. The distance between the shaft centres is 500 mm. The pitch dia of the smaller grooved pulley car be taken to be 150 mm. The factor of application is to be taken as 1.2. **(10 Marks)**

b. Select a standard v–belt to transmit 30 kW from an AC induction motor rotating at 1500 rpm to a centrifugal pump rotating at 750 rpm. The drive operates continuously for 8 hr /day. Calculate the number of belts. **(10 Marks)**

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