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EME602

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 140601

Roll No.

B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15

MACHINE DESIGN - II

Time : **3** Hours] [Total Marks : **100**

1 **Attempt any two questions in following part.[10×2=20]**

    (a) Define the following terms used in worm gearing:

        (i) Lead;(ii) Lead angle; (iii) Normal pitch; and

        (iv) helix angle

    (b) Design $20°$ involute worm and gear to transmit 10 kW with worm rotating at 1400 rpm. and to obtain a speed reduction of 10:1 The distance between the shafts is 225 mm.

    (c) A double threaded worm drive is required for power transmission between two shafts having their axes at right angles to each other. The worm has $14^1/_2{}^0$ involute teeth. The centre distance is approximately 200 mm. If the axial pitch of the worm is 30 mm and lead angle is 23^0, find (i) lead; (ii) Pitch circle diameter of worm and worm gear; (iii) Helix angle of the worm; and (iv) efficiency of the drive if the coefficient of friction is 0.05.

140601] **1** **[Contd...**

2   **Attempt any two questions in following part.[10×2=20]**

(a)   Write the expressions for static, limiting wear load dynamic load for spur gears and explain the various terms used there in.

(b)   A bronze spur pinion rotating at 600 rpm. Drives cast iron spur gear at transmission ratio of 4:1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105MPa respectively. The pinion has 16 standard 20^0 full depth involute teeth of module 8 mm, The face width of both the gears is 90 mm, Find the power that can be transmitted from the standpoint of strength.

(c)   A pair of helical gears is to transmit 15 kW. The teeth are 20^0 stub in diametral plane and have a helix angle of 45^0. The pinion runs at 10000 rpm. And has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given σ_{es} =618 MPa.

3   **Attempt any two questions in following part.[10x2=20]**

(a)   Define the following terms as applied to rolling contact bearings:

(i)   Basic static load rating (ii) Static equivalent load

(iii)   Basic dynamic load rating (iv) Dynamic equivalent load.

(b)   A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 KN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining

time of cycle. If the total life expected for the beating is 20 x 106 revolutions at 95 per cent reliability, calculate dynamic load rating of the bearing.

(c) Select a single row deep groove ball bearing for radial load of 4000 N and an axial load of 5000 N, operating at speed of 1600 rpm. for an average life of 5 years at 10 hour per day. Assume uniform and steady load.

4   Attempt any two questions in following part.   [10x2=20]

(a) Design a journal bearing for a centrifugal pump running at 1440 rpm, The diameter of the journal is 100 and load on each bearing is 20 kN. The factor ZN/p may be taken as 28 for centrifugal pump bearings. The bearing is running at 75^0C. temperature and the atmosphere temperature is 30^0C. The energy dissipation coefficient is 875 W/m^2/^{0}C. Take diametral clearance as 0.1 mm,

(b) Explain the following terms as applied to journal bearing: (i) Bearing characteristic number; and (ii) Bearing modulus. Also distinuish between Hydro dynamic bearing and Hydrostatic bearing.

(c) A journal bearing with a diameter of 200 mm and length 150 mm carries a load of 20kN, when the journal speed is 150 rpm. The diametral clearance ratio is 0.0015. If possible, the bearing is temperature at 35^0C ambient temperature without external cooling with a maximum oil temperature of $90°$C If external cooling is required, it is to be as little as possible to minimize the required oil flow rate and heat exchanger size.

(i)   What type of oil do you recommend?

(ii)   Will the bearing operate without external cooling?

(iii) If the bearing operates without external cooling, determine the operating oil temperature.

(vi) If the bearing operates with external cooling, determine the amount of oil in kg/min required to carry away the excess heat generated over heat dissipated, when the oil temperature rises from 85^0C to 90^0C, when passing through the bearing.

5 **Attempt any two questions in following part.[10x2=20]**

(a) A four stroke diesel engine has the following specifications :

Brake power = 5 kW; Speed = 1200 rpm; Indicated mean effective pressure=0.35 N/mm^2; Mechanical efficiency=80%.

Determine : 1. Bore and length of the cylinder; 2 thickness of the cylinder head; and

3. Size of studs for the cylinder head.

(b) Design a cast iron for a single acting four stroke engine for the following data : Cylinder bore=100 mm; Stroke = 125 mm; 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 if fuel=42 x 10^3 kJ/kg; Speed=2250 rpm.

Any other data required for the design may be assumed.

(c) Explain the following in brief:

(i) Effect of piston crown thickness and diameter on heat flow,

(ii) Lubrication of piston rings,

(iii) Stress induced in connecting rod.

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