CBCS SCHEME

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15ME64

Sixth Semester B.E. Degree Examination, July/August 2022
Design of Machine Elements – II

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Design Data Hand book is permitted.
3. Any missing data may be suitably assumed.

Module-1

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

b. Determine the combined stresses at the inner and outer fibers at the critical section of a crane hook which is required to lift loads upto 50 kN. The hook has trapezoidal cross section with inner and outer sides of 90mm and 40mm respectively and the depth being 120mm. The centre of curvature of the section is at a distance of 100mm from the inner side of the section and the load line passes through the centre of curvature. **(12 Marks)**

OR

2 a. Explain hoop stress and longitudinal stress in thin cylinders. **(04 Marks)**

b. A cast iron cylindrical pipe of outside diameter 300mm and inside diameter 200mm is subjected to an internal fluid pressure of 20 N/mm^2 and external fluid pressure of 5 N/mm^2. Determine the tangential and radial stresses at the inner, middle and outer surface. Sketch the tangential and radial stress distribution across its thickness. **(12 Marks)**

Module-2

3 a. Derive an expression for the stress induced in a helical spring with usual notations. **(06 Marks)**

b. A railway wagon weighing 40 kN and moving with a speed of 10 km/hour has to be stopped by four buffer springs in which the maximum compression allowed is 200mm. Find the number of turns in each spring of mean diameter 150mm. The diameter of spring wire is 25mm. Take G = 82.7 GPa. Also find the shear stress. **(10 Marks)**

OR

4 a. List the advantages of V-belt over Flat belt. **(04 Marks)**

b. Select a V-belt drive to transmit 5 kW from a shaft running at 800 rpm to another shaft to run at 300 rpm. The distance between the shaft centres is 400mm. The service is heavy duty varying from 10 hrs to 14 hrs/day. The diameter of the smaller pulley is 150mm. **(12 Marks)**

Module-3

5 Design a pair of spur gears to transmit 20 kW at 900 rpm of the pinion. The pinion is made of cast steel having allowable stress of 190 MPa. The gear is made of cast steel having allowable stress of 100 MPa and rotates at 144 rpm. The number of teeth on pinion is 16. The teeth are of 20° involute profile and ratio of face width to module is 10. Take service factor as 1.5 and C = 550 N/mm for dynamic load and check for wear to determine the hardness of gears. **(16 Marks)**

OR

6 The following data refers to a helical gear drive.
(i) Power transmitted 34 kW at 2800 rpm of pinion.
(ii) Speed reduction ratio is 4.5.
(iii) Helix angle 25°, pressure angle = 20° Fuel depth involute.
(iii) Material for both pinion and gear is medium carbon steel whose allowable stress may be taken as 230 MPa.
(iv) Pinion diameter is limited to 125mm.
Determine module and face width. Check the design for wear strength against dynamic loading. Assume service factor as 1.5 and wear and lubrication factor = 1.25 . **(16 Marks)**

Module-4

7 Design a worm gear drive to transmit a power of 2 kW at 1000 rpm. The speed ratio is 20 and the centre distance is 200mm. Assume pressure angle as 20° and full depth involute teeth. Take gear temperature as 65°C and ambient temperature as 25°C. **(16 Marks)**

OR

8 a. A multiplate clutch consists of five steel plates and four bronze plates. The inner and outer diameter of friction disks are 75mm and 150mm respectively. The coefficient of friction is 0.2 and the intensity of pressure is limited to 0.25 N/mm^2. Assuming uniform wear theory calculate (i) The operating force (ii) Power transmitting capacity at 720 rpm. **(08 Marks)**

b. A simple band brake shown in Fig.Q8(b) is to be designed to absorb a power of 30 kW at a rated speed of 720 rpm. Determine assuming c.o.f = 0.30
(i) The effort required to stop clockwise and counter clockwise rotation of the brake drum.
(ii) The dimensions of the rectangular cross section of the brake lever assuming its depth to be twice the width and allowable bending stress as 80 MPa. (iii) The dimension of the cross section of the band assuming its width to be ten times the thickness and allowable tensile stress as 50 MPa.

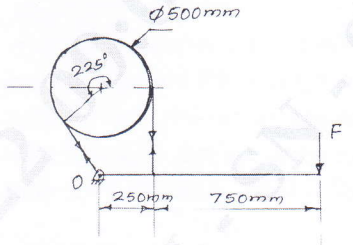

Fig.Q8(b) **(08 Marks)**

Module-5

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

b. A lightly loaded full journal bearing has the following specifications:
Bearing diameter = 80 mm, Bearing length = 60 mm , Diametral clearance = 0.12 mm, Speed = 24000 rpm, Viscosity of lubricating oil = 4 cp, Radial load = 900 N. Determine
(i) Frictional force (ii) Torque (iii) Power loss (iv) Coefficient of friction. **(08 Marks)**

OR

10 a. Define the following terms used in selection of ball bearing :
(i) Static capacity (ii) Dynamic capacity
(iii) Rating life (iv) Equivalent load. **(08 Marks)**

b. Select a suitable ball bearing to carry a radial load of 3000 N ad a thrust load of 2000 N. The service imposes light shock and the bearing will be in use for 3 years at 10 hrs/day. The speed of shaft is 1200 rpm. The shaft diameter is 50mm. **(08 Marks)**

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