2002 SCHEME

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AU53

Fifth Semester B.E. Degree Examination, June 2012

Design of Machine Elements–II

Time: 3 hrs. Max. Marks:100

Note: 1.*Answer any FIVE full questions.*
2.Use of design data handbooks and approved charts/graphs is allowed.

1 a. The section of crane hook is symmetrical trapezium 90 mm deep, inner width being 60 mm and outer width being 30 mm. The hook carries a vertical load of 25 KN. Inner radius of the hook is 100 mm, the load line is nearer to the radius of the hook by 25 mm than the center of curvature at the critical section. Calculate the maximum tensile and compressive stresses. **(10 Marks)**

b. A single row deep groove ball bearing has a specific dynamic capacity of 46.3 KN. The actual radial load is F_r = 9KN. The speed of rotation is 1800 rpm. What is the life in (a) Cycles of operation; (b) In hours; (c) What is the average life? **(10 Marks)**

2 a. Design a spring for an elevator shaft at the bottom of which 8 identical springs are set in parallel to absorb the shock of the elevator in case of failure. The weight of elevator is 60 KN and the counter weight of elevator is 20 KN. The elevator has a free fell of 1.5 meters form rest. The spring is made of 25 mm diameter rod. Determine the maximum stress in each spring, if the index is 6. Each spring has 15 active turns take G= 84 GPa. **(10 Marks)**

b. An automobile semi elliptical leaf spring has 12 number of graduated leaves and 3 number of full length leaves. The spring is sustain a load of 25 KN at its center and the ratio of total depth to the width of the spring is 2.5. The material of the leaves has design normal stress of 450 MPa and modulus of elasticity of 207 GPa. Determine; (a) Width and thickness of leaves; (b) Initial gap between the full length and graduated leaves; (c) Bolt load; (d)Central deflection; (e) Radius of curvature of first full length leaf. The width of central band is 100 mm and the span of the leaves is 1200 mm. **(10 Marks)**

3 a. A simple band brake of 500 mm drum diameter is to absorb 30 KW at 1000 rpm. A vertical line passing through center of the drum passes through the fulcrum which is 350 mm below the center of the drum. The length of lever is 800 mm. One end of the band is attached to the brake lever at a distance of 250 mm from the fulcrum and the other end is attached to the fulcrum it self; (a) The dimensions of rectangular cross section of the brake lever assuming that the depth is twice the width. Assume the permissible stress of brake lever material is 200 MPa; (b) The dimensions of rectangular cross section of the band assuming that width is ten times the thickness. Assume the allowable tensile stress in the band between 50–60 MPa. **(10 Marks)**

b. A cone cultch has a semi cone angle of 12° to transmit 10 KW at 750 rpm. The width of the face is one fourth of mean diameter of friction lining. If the normal intensity of pressure between the contacting surface is not to exceed 0.85 bar, assuming uniform wear criterion and taking μ=0.2. Calculate dimensions of clutch. Also find the axial force while running i.e. at beginning of engagement. **(10 Marks)**

4 a. Derive Petroff's equation for the coefficient of friction in a lightly loaded bearing. **(06 Marks)**

b. A full journal bearing having diameter of 50 mm and 100 mm long has a bearing pressure of 1.2 N/mm^2. The speed of the journal is 1000 rpm. The bearing is lubricated at 75°C [bearing surface temperature] having viscosity of 0.011 Pas. The room temperature is 35°C. Take the minimum film thickness as $\frac{1}{4}^{th}$ diametral clearance. The specific heat of oil is 1850 J/kg$^\circ$C. The ratio of journal diameter to diametral clearance is 1000. Calculate (a) Load which can be supported by bearing (b) Power loss due to friction; (c) Attitude of bearing and ecentricity; (d) The amount of artificial cooling is required. **(14 Marks)**

5 a. A roller chain is to transmit 66.24 KW from 17 teeth sprocket to a 34 teeth sprocket at a pinion speed of 300 rpm. The loads are moderate shock. The equipment is to run 18 hours per day. Specify the length and size of chain required for a center distance about 25 pitches. **(10 Marks)**

b. Select a V– belt drive to transmit 10 KW of power from a pulley of 200 mm diameter mounted on electric motor running at 720 rpm to another pulley mounted on compressor running at 200 rpm. The service is heavy duty varying from 10 hours to 14 hours per day and centre distance between centres of pulleys is 600 mm. **(10 Marks)**

6 a. Derive an expression for beam strength of a spur gear tooth (Lewis equation) using standard notations. **(06 Marks)**

b. A pair of helical gears is to transmit 15 KW. The teeth are 20° full depth in normal plane and have helix angle of 30°. The pinion has 24 teeth and operates at 10,000 rpm . The velocity ratio is 5 to 1. The pinion is made of cast steel [50MPa] and the gear is bronze [40 MPa]. The pinion material is hardened to 200 BHN. Design the gear pair. **(14 Marks)**

7 a. Explain significance of formative number of teeth in bevel gears. **(04 Marks)**

b. Design a pair of bevel gear to transmit 12 KW at 300 rpm of the gear and 1470 rpm of the pinion. The angle between the shaft axes is 90°. The pinion has 20 teeth and material for the gear is cast steel C 30 untreated. Take service factor as 1.25 and check the gears for wear and dynamic load. **(16 Marks)**

8 Design a worm gear drive to transmit 2 KW at 1200 rpm. The speed ratio is 30 and the center distance is 160 mm. The worm gear is made of phosphor bronze with allowable bending stress of 55 MPa. Tooth from is 20° full depth involute. The worm is made of hardened steel. **(20 Marks)**

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