USN

10ME62

Sixth Semester B.E. Degree Examination, June/July 2015

Design 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 design data handbook is permitted.

PART – A

1 a. Determine the value of 't' in the cross section of a curved machine member shown in Fig. Q1(a), so that the normal stresses due to bending at extreme fibers are numerically equal. Also determine the normal stresses so induced at extreme fibers due to a bending moment of 10 KN – m. **(10 Marks)**

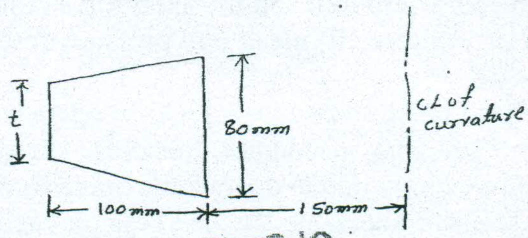

Fig.1Q(a)

b. A cast iron cylindrical pipe of outside diameter 300 mm and inside diameter 200 mm 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. **(10 Marks)**

2 a. A nylon core flat belt 200 mm wide weighing 20 N/m, connecting a 300mm diameter pulley to a 900 mm diameter driven pulley at a shaft spacing of 6 m, transmits 55.2 kW at a belt speed of 25 m/sec i) calculate the belt length and the angles of wrap ii) compute the belt tensions based on a co-efficient of friction 0.38. **(10 Marks)**

b. Two shafts one metre apart are connected by a V – belt to transmit 90 kW at 1200 rpm of a driver pulley of 300 mm effective diameter. The driven pulley rotates at 400 rpm. The angle of groove is 40° and the co-efficient of friction between the belt and the pulley rim is 0.25. The area of the belt section is 400 mm^2 and the permissible stress is 2.1 MPa. Density of belt material is 1100 kg/m^3. Calculate the number of belts required and the length of the belt. **(10 Marks)**

3 a. A railway wagon weighting 50 kN and moving with a speed of 8 km/hr has to be stopped by four buffer springs in which the maximum compression allowed is 220 mm. Find the number of turns or coils in each spring of mean diameter 150mm. The diameter of spring wire is 25 mm. Take G = 84 GPa. Also find the shear stress. **(10 Marks)**

b. A multi leaf spring with camber is fitted to the chassis of an automobile over a span of 1.2 m to absorb shocks due to a maximum load of 20 kN. The spring material can sustain a maximum stress of 0.4 GPa. All the leaves of the spring were to receive the same stress. The spring is required at least 2 full length leaves out of 8 leaves. The leaves are assembled with bolts over a span of 150 mm width at the middle. Design the spring for a maximum deflection of 50 mm. **(10 Marks)**

4 Design a bronze spur gear 81.4 MN/m^2 and mild steel pinion 101 MN/m^2 to transmit 5 KW at 1800 rpm. The velocity ratio is 3.5 : 1. Pressure angle is 14½°. Not less than 15 teeth are to be used on either gear. Determine the module and face width. Also suggest suitable surface hardness for the weaker member based on dynamic and wear considerations. **(20 Marks)**

PART – B

5 a. A pair of mitre gears have pitch diameter 280 mm and face width of 36 mm and run at 250 rpm. The teeth are of 14½° involute and accurately cut and transmit 6 KW. Neglecting friction angle, find the following : i) outside diameter of gears ii) resultant tooth load tangent to pitch cone iii) radial load on the pinion iv) trust on the pinion. Assume low carbon cast steel 0.2 %C heat treated as the material for both the gears. **(12 Marks)**

b. The following data refer to a worm and worm gear drive that has to transmit 15 KW at 1750 rpm of the worm. Centre distance = 200 mm number of starts = 4, transmission ratio = 20 pitch circle diameter of worm = 80 mm, axial module = 8 mm tooth form = 20°FDI. The worm gear has an allowable bending stress of 55 MPa. The worm is made of hardened and ground steel. Determine : i) the number of teeth on the worm gear ii) the lead angle iii) face width of the worm gear based on the beam strength of the worm gear. **(08 Marks)**

6 a. In a multiple disc clutch the radial width of the friction material is to be 0.2 of maximum radius. The co-efficient of friction is 0.25. The clutch is to transmit 60 KW at 3000 rpm. Its maximum diameter is 250 mm and the axial force is limited to 600 N. Determine i) number of driving and driven discs ii) mean unit pressure on each contact surface. Assume uniform wear. **(10 Marks)**

b. A differential band brake shown in Fig. Q6(b) operates on a drum diameter of 500 mm. The drum rotates at 300 rpm in counter clockwise direction and absorbs 36 KW, μ = 0.25 determine : i) force F required to operate the brake ii) width of band required for this brake if thickness is 5 mm and allowable tensile stress on band material is 72 N/mm^2 iii) design the lever if the maximum force is twice that of calculated force. Use C30 steel (σ_u = 540 MPa) and FOS = 4 based on ultimate stress. And also depth equal to thrice the width. **(10 Marks)**

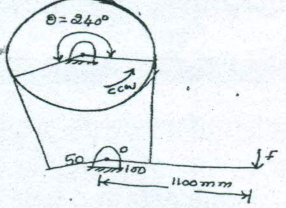

Fig.6Q(b)

7 a. Derive Pertroff's equation for a lightly loaded bearing. **(10 Marks)**

b. A full journal bearing 50 mm in diameter and 50 mm long operates at 1000 rpm and carries a load 5 kN. The radial clearance is 0.025 mm. The bearing is lubricated with SAE 30 oil and the operating temperature of oil is 80°C. Assume the attitude angle as 60°. Determine : i) bearing pressure ii) sommerfield number iii) attitude iv) minimum film thickness v) heat generated vi) heat dissipated if the ambient temperature is 20°C vii) amount of artificial cooling if necessary. **(10 Marks)**

8 Design a suitable aluminium alloy piston with two compression rings and one oil ring for a petrol engine of following particulars :

Cylinder diameter	= 0.10 m
Peak gas pressure	= 3.2 MPa
Mean effective pressure	= 0.8 MPa
Average side thrust	= 2400 N
Skirt bearing pressure	= 0.22 MPa
Bending stress in piston crown	= 36 MPa
Crown temperature difference	= 70°C.
Heat dissipated through crown	= 157 kJ/m^{2}s = 157 KW/m^2
Allowable radial pressure	= 0.04 MPa
Bending piston on rings	= 90 MPa
Heat conductivity k	= 160 W/m/°C

Assume any further data required for the design. **(20 Marks)**

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