USN | | | | | | | | | | |

10AU63

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. Missing data, if any, may be suitably assumed.
3. Use of data handbook is permitted.

PART – A

1 a. The horizontal cross section of a crane hook is an isosceles triangle of 120 mm deep, the inner width being 90 mm. The hook carries a load of 50 kN. Inner radius of curvature is 100 mm. The load line passes through the centre line of curvature. Determine the stresses at the extreme fibres. **(12 Marks)**

b. Derive an expression for normal stresses due to bending at the extreme fibres on the cross section of a curved machine member. **(08 Marks)**

2 a. A cast iron thick cylinder of internal diameter 150 mm is subjected to an internal pressure of 12 N/mm^2. The allowable working stress for the cast iron may be taken as 20 N/mm^2. Determine
i) Thickness of cylinder wall.
ii) Thickness of the circular flat cylinder head cast integral with the cylinder walls. **(06 Marks)**

b. A cast iron cylindrical pipe of outside diameter 300 mm and inside diameter 200 mm is subject 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. Also sketch the tangential stress and radial stress distribution across its thickness. **(14 Marks)**

3 a. Derive an expression for the deflection in a helical compression spring with usual notations. **(08 Marks)**

b. A railway wagon weighing 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 which spring of mean diameter 150 mm. The diameter of spring wire is 25mm. Take G = 84 GPa. Also find the shear stress. **(12 Marks)**

4 a. A cone clutch has a semi-cone angle of 12.5° to transmit 40 kW at 1000 rpm. The width of the face is one sixth of the mean diameter of friction lining. If the normal intensity of pressure between the contacting surface is not to exceed 0.2 N/mm^2. Assuming uniform wear criterion and taking μ = 0.4. Calculate dimensions of clutch. Also find axial force while running i.e., at the beginning of engagement. **(10 Marks)**

b. A single block brake with drum diameter of 400 mm is shown in Fig.Q4(b). It rotates at a speed of 150 rpm. The friction material permits a maximum pressure of 0.5 MPa and $\mu = 0.25$. Face width of the block is 50 mm. Determine (i) Effort (ii) Maximum Torque (iii) Heat generated. **(10 Marks)**

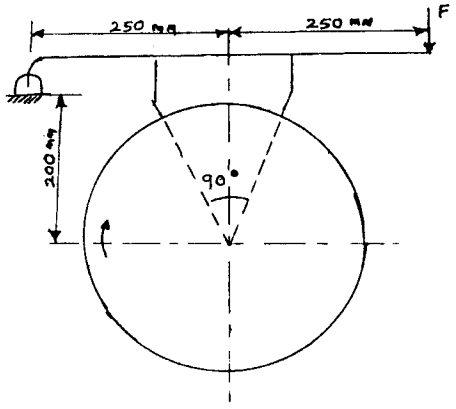

Fig.Q4(b)

PART – B

5 A pair of carefully cut spur gears with 20° full depth involute profile is used to transmit 12 kW at 1200 revolutions per minute of pinion. The gear has to rotate at 300 revolutions per minute. The material used for both pinion and gear is medium carbon steel whose allowable bending stress may be taken as 230 MPa. Determine the module and facewidth. Also suggest suitable surface hardness. Take 24 teeth on pinion. Modulus of elasticity may be taken as 210 GPa. **(20 Marks)**

6 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 200 mm. Assume hardened steel worm and phosphor bronze ($\sigma_{o2} = 55$ N/mm^2) worm wheel. Approximate $y = 0.154 - \frac{0.912}{z}$. **(20 Marks)**

7 a. Derive Petroff's equation for coefficient of friction in journal bearings. **(08 Marks)**

b. A 75 mm long full journal bearing of diameter 75 mm supports a radial load of 12 kN at the shaft speed of 1800 rev/min. Assume ratio of diameter to the diametral clearance as 1000. The viscosity of oil is 0.01 Pas at the operating temperature. Determine the following :
(i) Summerfeld number.
(ii) The coefficient of friction based on McKee equation.
(iii) Amount of heat generated. **(08 Marks)**

c. Explain Hydrodynamic theory of lubrication. **(04 Marks)**

8 a. A 20 mm 8×19 steel wire rope is used with a hoisting drum of 1 m diameter to lift a load of 20 kN. The depth of mine is 800 m and the acceleration is 3 m/sec^2. Determine the number of ropes required using a factor of safety 5. Neglect the weight of skip. Take modulus of elasticity of rope = 82728.5 MPa. **(10 Marks)**

b. A belt of 100 mm wide and 10 mm thick is transmitting power at 1000 m/min. The net driving tension is 2 times the slack side tension. Allowable stress in the material is 2 MPa. Specific weight of the belt material is 10 kN/m^3. Determine the power that can be transmitted by the belt. Also determine the absolute power that can be transmitted by the belt and the velocity at which that power can be transmitted. **(10 Marks)**

* * * * *