Theory of Machine-II

Sem-V[Mechanical Engg.]

Assignment No. 1

[Clutches and Brakes]

1. a) A car engine rated at 10 kW gives maximum torque of 100 Nm. The clutch has single plate with both sides effective and the coefficient of friction is 0.3, mean axial pressure is limited to 0.1 N/mm^2 and the ratio of radii of the friction surface is 1.25, find the dimensions of the clutch plate and the total axial pressure which must be excreted by the spring. First derive the formula used and apply it.

   b) A cone clutch transmits 20 kW at 1600 rpm. The following data apply; cone angle=30^0, maximum intensity of pressure= 0.8 X 10^5 Nm, the mean radius is twice the width of the friction surface, coefficient of friction=0.3. Determine (i) the dimensions of the contact surface (ii) the axial load or force to keep the clutch engaged when transmitting power (iii) the width of the friction surface. Assume uniform wear.

   c) 100 kW is transmitted at 3000 rpm by a multiple disc friction clutch. The plates are having friction surface coefficient of 0.07 and axial intensity of pressure is not to exceed 1.5 bar. External radius is 1.25 times internal radius and the external radius is 12.5 cm. Determine number of plates needed to transmit the required torque assuming uniform wear.

2. a) A differential band brake acting on the ¾ th of the circumference of 450 mm diameter is to provide a braking torque of 225 Nm. One end of the band is attached to a pin 100 mm from the fulcrum of the lever and the other end to another pin 25 mm from the fulcrum on the other side of it to where the operating force is also acting. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the two values of the operating force corresponding to two direction of rotation of drum.

   b) Derive with neat sketch a centrifugal clutch and derive the formula for total torque transmitted.

3. a) A car is moving on a level road at a speed of 60 km/hr has a wheel base of 2.76 meters, distance of C.G. from the ground level is 500 mm, the distance of C.G. from the rear wheel is 1.10 meters. Find the distance travelled by the car before coming to rest when the brakes are applied to i) rear wheels II) front wheels iii) all four wheels. The coefficient of friction between the road and tyres is o.5.

   b) A car moving on a rough inclined surface having following data:-

      angle of inclination of plane- 15^0

      wheel base of the car= 2 m.

      height of CG of the car from rear axle = 1m.

      perpendicular distance of CG from rear axle =0.9 m.

      speed of car= 54 km/hr.

      coefficient of friction between tyres and road= 0.6

      Brakes are applied to all four wheels.

   Determine:-

      i) distance travelled by the car before coming to rest

      ii) time taken in doing so if,

         a. the car is moving up the plane, and

         b. the car is moving down the plane.