**Part – A**   **(10 x 3=30 marks)**
(All questions are compulsory)

1. (a) State Coulomb's laws of dry friction.

   (b) Explain angle of repose with a sketch.

   (c) Define sensitivity of governors.

   (d) What is the function of governor? How does it differ from a flywheel?

   (e) Write an expression for Kinetic energy of a rigid body undergoing
       general plane motion(rolling without slipping) and explain the
       expression.

   (f) What is centrifugal tension in a belt and how does it affect power
        Transmitted?

   (g) A block of 50kg mass is pushed up an incline plane by a force acting
       parallel to incline plane. The angle of inclination is 30^0 and coefficient
       of friction is 0.25. Find the force required to impend motion in upwords
       direction along incline plane.

   (h) What are the advantages of using rope drives?

   (i) What is the advantage of using cross belt drive compared to
        open belt?

   (j) A 44.5 N weight is suspended by a helical spring having a constant k =
       890 N / m. Neglecting the mass of spring, find the time period t for
       small amplitudes of vertical vibration.

(Answer any 5 of the following)

2. A multi-disc clutch transmitting 25 kW of power at 1500 rpm has three discs on the driving shaft and two on the driven shaft. The outside and inside diameters of the contacting surfaces are 240 mm and 120 mm respectively.   Assuming the condition of uniform wear, determine the maximum axial intensity of pressure between the discs. Take coefficient of friction as 0.3.   (14)

3.(a) A single start square threaded spindle of a screw jack has mean diameter of 45 mm and a pitch of 10 mm.   If coefficient of friction between the screw and nut is 0.25, determine (i) the force required to be applied at the screw to raise a load of 5000 N, (ii) efficiency of screw jack and (iii) the force required to be applied at pitch radius to lower the same load of 5000 N Neglect friction between the nut and the collar.   (4+3+3=10)

   (b) Is the screw jack mentioned above self locking? Which type of screw jack will you recommend, over hauling or self locking and why?   (4)

4. A flywheel is made up of steel ring 40 mm thick and 200 mm wide plate with mean diameter of 2 metres. If initially the flywheel is rotating at 300 r.p.m., find the time taken by the wheel in coming to rest due to frictional couple of 100 Nm. Take mass density of the steel as 7900 kg/m³. Neglect the effect of inertia of the spokes. The flywheel may be treated as thin ring.   (14)

5. The brake drum of a single block brake is rotating at 500 r.p.m. in the clockwise direction. The diameter of the drum is 400 mm and the single block brake is of the type as shown in Figure given below:
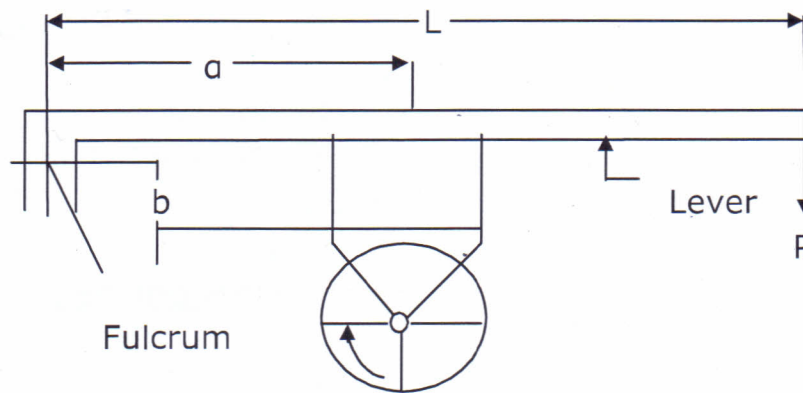
The force P required at the end of the lever to apply the brake is 300 N. If angle of contact is 30^0 and L = 1 m, a = 300 mm and b = 25 mm then determine the braking torque. The co-efficient of friction is equal to 0.3. (14)

6.(a) A body performs simple harmonic motion in a straight line. Its velocity is 12 m/s when the displacement is 50 mm, and 3 m/s when the displacement is 100 mm. The displacement is measured from the mid position. Calculate the frequency and amplitude of motion. What is the acceleration when the displacement is 75 mm from the mid position? (3+3+4=10)

(b) What is centre of Percussion? What is the significance of centre of Percussion? (4)

7. A 100 mm wide and 10 mm thick belt transmits 5 kW of power between two parallel shafts. The distance between the shaft centres is 1.5 m and the diameter of smaller pulley is 440 mm. The driving and driven shafts rotate at 60 rpm and 150 rpm respectively. The coefficient of friction is 0.22. Find the stress in the belt if the two pulleys are connected by an open belt. (14)

8.In a porter governor shown in figure below, each of the arms is 400 mm long. The upper arms are pivoted on the axis of the sleeve where as the lower arms are attached to the sleeve at a distance of 45 mm from the axis of rotation. Each ball has a mass of 8 kg and the load on the sleeve is 60 kg. What will be the equilibrium speeds for the two extreme radii of 250 mm and 300 mm of rotation of the governor balls? (7+7=14)

P.T.O.

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