

This Exam measures the following course ILOs

a1, a3, a4, a5, a8, a16, a19, b1, b2, b3, b4, b5, b6, b7, b9, b13, b14, b15 c1, c2, c3, c4, and c13

1. (15 Marks)

A cylindrical helical spring is made of 0.6 cm diameter wire, number of coils 20, and mean diameter 7.5 cm. Find the tensile load which may be applied on the spring if the shear stress must not exceed 18 kgf/cm². How much will be the deflection in this case.

$$G = 8 \text{ kgf/cm}^2, \quad K = 1 + 1.5/c, \quad c = D/d \quad \frac{8kPD}{\pi d^3} \leq \tau_d \quad \lambda = \frac{8PD^3i}{GD^4}$$

2. (20 Marks)

A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 kW at 1250 r.p.m. The outer diameter of the contact surfaces is to be 300 mm. The coefficient of friction is 0.4.

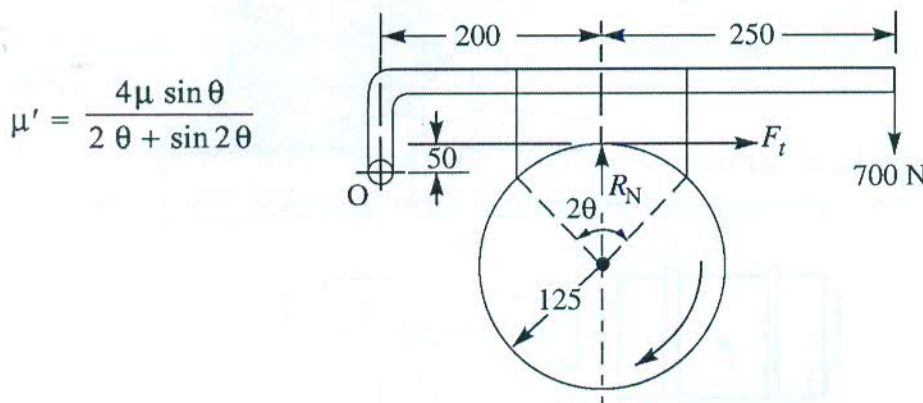
(a) Assuming a uniform pressure of 0.17 N/mm²; determine the inner diameter of the friction surfaces.

(b) Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of pressure when uniform wear conditions have been reached.

$$p.r = C, \quad T = n.\mu.W.R, \quad R = \frac{2}{3} \left[\frac{(r_1)^3 - (r_2)^3}{(r_1)^2 - (r_2)^2} \right]$$

3. (15 Marks)

A single block brake is shown in Fig. 1. The diameter of the drum is 250 mm and the angle of contact is 90°. If the operating force of 700 N is applied at the end of a lever and the coefficient of friction between the drum and the lining is 0.35, determine the torque that may be transmitted by the block brake.



All dimensions in mm.

Fig. 1

$$\mu' = \frac{4\mu \sin \theta}{2\theta + \sin 2\theta}$$

4. (20 Marks)

Draw complete constructional drawing showing the very fine constructional details of the double disc clutch shown in Fig. 2.

5. (30 Marks)

The kinematic scheme of a power transmission system is shown in Fig. 3. A is the electric motor, B is a friction safety coupling (containing double cone friction surfaces) which limits the transmitted torque. C is two steps toothed gear reducer. The first step consists of a pair of spur gears. Make a complete constructional drawing showing the very fine constructional details of the **shaft I**, showing the safety coupling, pinion gear, rolling contact bearings, sealing devices, and lubrication device.

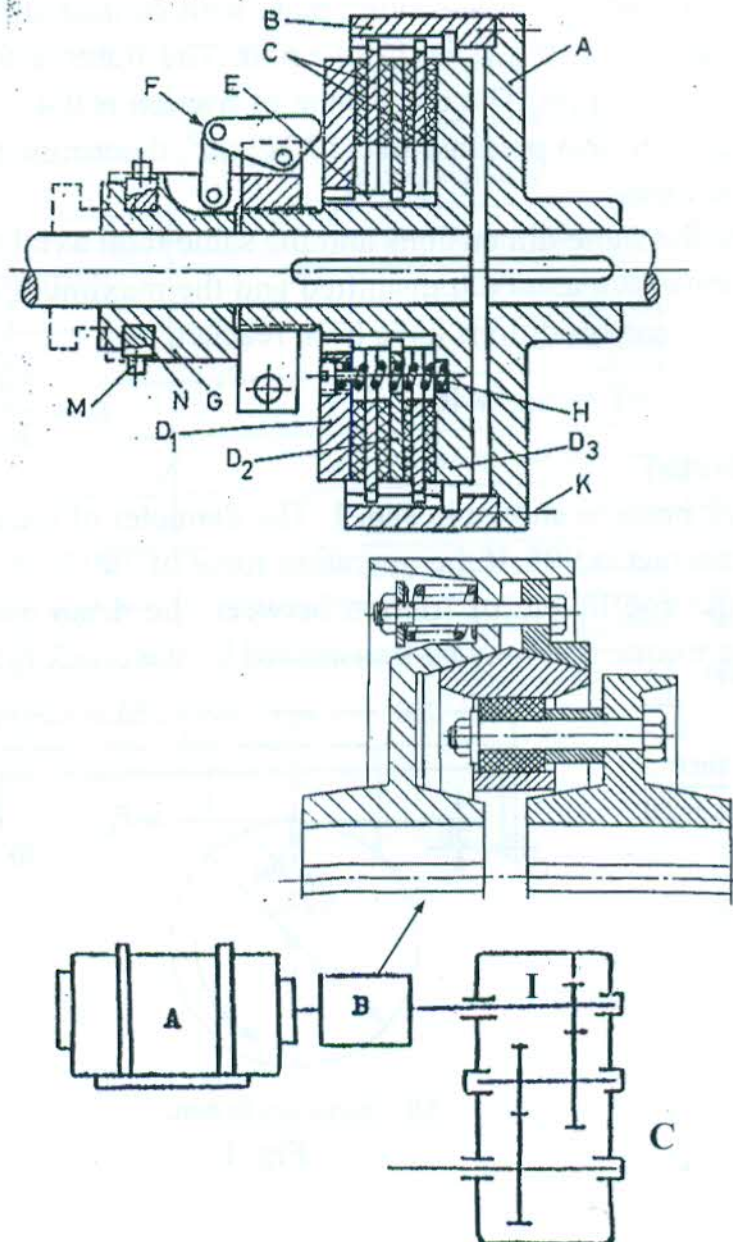


Fig. 2

Fig. 3