

PART – A (10 X 2 = 20 MARKS)

1. Define the following terms (i) Kinematic link (ii) mechanism.
2. Write a short note on the instantaneous centre method.
3. Differentiate between bearings and clutches.
4. Write a note on the theory of lubrication.
5. Write down the expression for tension ratio in a V-belt drive.
6. With a neat sketch explain the working of a single plate-clutch.
7. With a neat sketch explain the following terms in a cam and follower mechanism (i) prime circle (ii) pressure angle.
8. Write a note on constant velocity motion of a follower in a cam and follower mechanism.
9. Differentiate between a compound gear train and a reverted gear train.
10. Define the following terms in a governor (i) sensitivity (ii) hunting.

PART – B ( 5 x 16 = 80 marks)

11. In a flat collar thrust bearing the inner and outer radii are 120 mm and 72 mm respectively. The total axial thrust is 60 kN and the intensity of pressure is 0.25 MPa. If the coefficient of friction is 0.05 and shaft rotates at 600 rpm, determine the power lost in overcoming the friction. Also determine the number of collars required to withstand the axial thrust.
- 12.a) The following data relate to a slide-crank mechanism:
 

Crank radius	150 mm
Length of connecting rod	600 mm
Crank angle	45°
Crank speed	300 rpm in clockwise direction

 Determine: (i) the acceleration of piston (ii) angular acceleration of connecting rod.

[OR]

- 12.b) The link AB of a four bar mechanism as shown in Fig.(1), revolves uniformly at 120 rpm in clockwise direction. Find the angular acceleration of links BC and CD. The dimensions of various links are as given AB=40 mm, BC = 100 mm, CD = 80 mm, AD = 60 mm and LDAB = 90°.
13. a) A leather belt is required to transmit 10 kW with 1 m diameter pulley running at 300 rpm. The angle of contact is 160° and coefficient of friction between belt and pulley is 0.32. If the allowable strength of belt is 1.25 N/mm<sup>2</sup> and the belt thickness is 10 mm, determine the width of the belt. Density of belt material is 1000 kg/m<sup>3</sup>.

[OR]

- 13.b) A plate clutch has three discs on the driving shaft and two discs on the driven shaft. The outside diameter of the contact surfaces is 240 mm and inside diameter is 120 mm. Assuming uniform

pressure and coefficient of friction 0.3, determine the total axial force on the springs to transmit 25 kW at 1500 rpm. If there are 6 springs each of stiffness 10 kN/m and each of contact surface has worn away by 0.5 mm, what is the maximum power that can be transmitted at the same speed with uniform wear?

14.a) A cam with 30 mm minimum radius is rotating clockwise at 1200 rpm to give the following motion to a roller follower of 20 mm diameter.

- (i) Lift = 25 mm
- (ii) Follower rises during  $120^\circ$  cam rotation with simple harmonic motion
- (iii) Follower to dwell for  $60^\circ$  cam rotation
- (iv) Follower to return during  $90^\circ$  cam rotation with uniform acceleration and deceleration
- (v) Follower to dwell for remaining period.

Draw the profile of the cam and determine the maximum velocity and acceleration during rise and return stroke.

[OR]

14.b) A cam rotating clockwise with a uniform speed of 300 rpm is to give the roller follower of 15 mm diameter the following motion:

- (i) Follower to rise through a distance of 45 mm during  $120^\circ$  cam rotation.
- (ii) Follower to dwell for  $60^\circ$  of cam rotation.
- (iii) Follower to return to its initial position during next  $120^\circ$  of cam rotation.
- (iv) Follower to dwell for remaining period of  $60^\circ$  of cam rotation.

15.a) In an epicyclic gear train as shown in Fig.(2), the arm A is fixed to the shaft S. The gear B having 80 teeth rotates freely on the shaft S and gear D with 120 teeth is separately driven. If the arm A runs at 100 rpm and gear D at 50 rpm in same direction, find the speed of gear B.

[OR]

15.b) A Porter governor has all the four arms 300 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35 mm from the axis. The mass of each ball and the sleeve are 7 kg and 54 kg respectively. If the extreme radii of rotation of the balls are 200 mm and 250 mm, determine the range of speed of the governor.

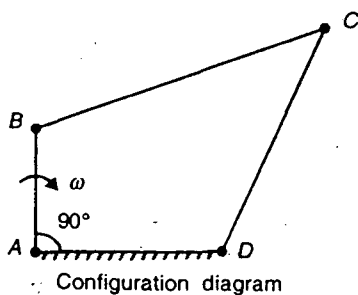


FIGURE 1

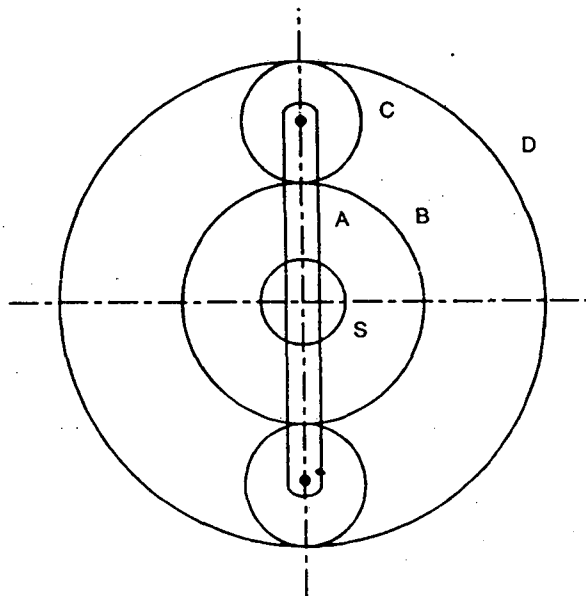


FIGURE 2