Roll No. **Total No. of Pages : 03**

Total No. of Questions : 09

B.Tech. (ME / AE / IE-2008/09 Batch) (Sem.–3rd)

THEORY OF MACHINES-I

Subject Code : ME-203

Paper ID : [A0802]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Answer briefly :

(a) What is a kinematic chain ?

(b) Define simple and compound mechanisms.

(c) What is law of belting ?

(d) State the Kennedy' theorem of instantaneous centres.

(e) Explain the term initial tension in belts.

(f) What is the difference between brake and dynamometer ?

(g) What is the difference between governor and flywheel ?

(h) Explain why cycloidal motion of follower is useful for high speed engines?

(i) Explain the term power of governor.

(j) Explain why about 90% mass of flywheel is conserved in its rims?

SECTION-B

2. A shaft has a number of collars integral with it. External diameter of collars is 400 mm and the shaft diameter is 250 mm. If the uniform intensity of pressure is 35×10^4 N/m^2 and its coefficient of friction is 0.05, estimate :

   (a) Power absorbed in overcoming friction when the shaft runs at 105 r.p.m. and carries a load of 15×10^4 N, and

   (b) Number of collars required

3. The ratio between the width of the front axle and that of the wheel of a steering mechanism is 0.44. At the instant when the front inner wheel is turned by 18°, what should be the angle turned by the outer front wheel for perfect steering ?

4. A rope pulley is designed to transmit 30 kW. Diameter of pulley = 360 mm, speed = 120 rpm, Angle of groove = 45°. Angle of lap on smaller pulley = 170°. Coefficient of friction = 0.27. Number of ropes = 10. Mass of the rope 55C^2 kg/m and working tension in the rope is limited to 125C^2 kN, where C = circumference of rope in meter. Find :

   (a) Initial tension, and (b) diameter of each rope.

5. A punching machine having a stroke of 10 cm, punches a 1.25 cm hole once every 10 second in a 1 cm steel plate. During punching operation it does 600 N-m of work per square cm of sheared area. The maximum linear speed of the flywheel rim is not to exceed 30 m/s. Design a suitable flywheel if this speed is not to fall below 27.5 m/s.

6. Refer to figure-1 where crank OA rotates uniformly at 20 rad/s clockwise, determine the velocity of the slider A and angular velocity of link BC.

   BC = 18 cm

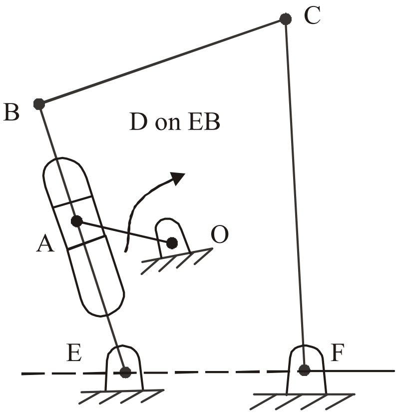
   FC = 25 cm

   OA = 7.5 cm

   EB = 27 cm

   EF = 6 cm

   LEFC = 90°



SECTION-C

7. Figure-2 shows a four bar mechanism. Find the angular acceleration of CD and linear acceleration of point R. Given :

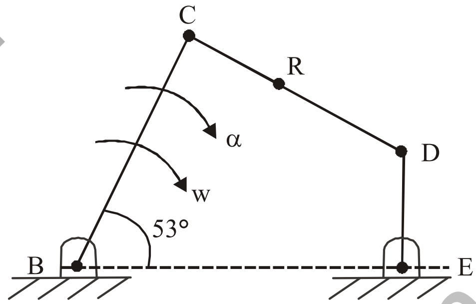
   α = 4400 rad/sec^2

   ω = 100 rad/sec

   BC = 75 mm, CD = 80 mm

   BE = 125 mm, DE = 37 mm

   CR = 28 mm



8. The exhaust valve of a gas engine opens 55° before outer dead centre and closes 15° after inner dead centre. A cam operates this valve. The minimum radius and lift of cam are 4.0 cm and 1.5 cm respectively. Valve opens with constant acceleration and retardation, acceleration being twice the retardation. Period for closing the valve is the same as for opening. The follower returns with S.H.M. Draw the profile of cam if the roller radius is 1.5 cm and offset is 1.0 cm to the right of cam centre.

9. For a spring controlled Hartnell type governor, following data is provided:

   mass of the governor ball = 1.80 kg

   length of the vertical bell crank lever = 8.75 cm

   length of other arm of bell crank lever = 10.0 cm

   The speeds corresponding to radii of rotations of 12 cm and 13 cm are 296 and 304 r.p.m. respectively. Find the stiffness of spring.