3 Hours **Total Marks: 80**

- Question-1 is compulsory.
- Answer any three from remaining five questions.
- Assume any suitable data, wherever required, but justify the same. Assumptions made should be clearly stated.
- Illustrate the answers with sketches, wherever required.

I Answer any four of the following:

a. List the inversions of the single slider mechanism and explain the working of the oscillating cylinder engine mechanism. **(05)**

b. Compare Ackermann and Davis steering gear mechanism. **(05)**

c. Compare involute and cycloidal gear teeth profiles. **(05)**

d. Compare open and cross belt drive belt arrangemnts **(05)**

e. Derive an expression for Coriolis component of acceleration. **(05)**

II a. The mechanism shown in fig.1 in which crank OA rotates in clockwise direction at uniform speed at 200 rpm. Determine the velocity and acceleration of slider 'P'. **(12)**

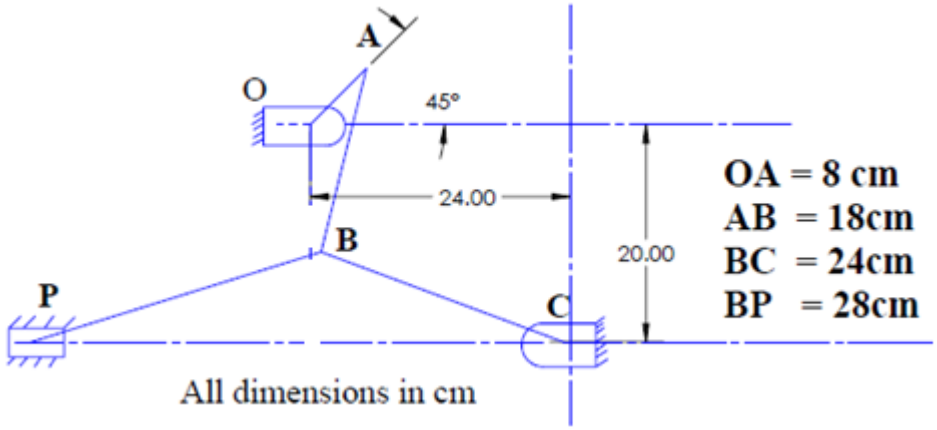


Fig. 1

II b. Derive an expression for velocity ratio of driving and driven shaft speed in a single Hooke's joint. **(08)**

III a. A sphere of radius 0.1m starts rolling without slip up on an inclined plane. The angle of plane is 30° with the horizontal. If the initial angular velocity of the sphere is 5 rad/sec, determine how far the sphere will travel before it reverse its motion. **(10)**

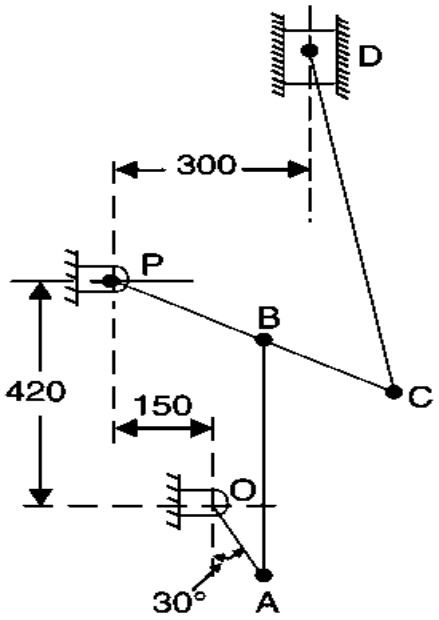
III b. Sketch a pantograph and explain its working. **(06)**

III c. Explain static forces acting on spur gear when two gears are in mesh with neat sketch. **(04)**

IV a. A flat belt drives a pulley, the angle of the lap being 120°. The belt is 100 mm wide and 6 mm thick. The density of belt material is 1000 kg/m^3. If the coefficient of friction is 0.3 and the maximum stress in the belt should not exceed 2 MPa, find the maximum power that the belt can transmit and the corresponding speed of the belt. **(10)**

IV b. Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 5 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 150 r.p.m. Determine: 1. The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel, 2. The length of path and arc of contact, 3.The number of pairs of teeth in contact, and 4. The maximum velocity of sliding. **(10)**

Va. Fig. 2 shows a mechanism in which crank OA rotates uniformly at 200 r.p.m. in the clockwise direction. The various lengths are: OA = 150 mm ; AB = 450 mm; PB = 240 mm ; BC = 210 mm ; CD = 660 mm. Determine the velocity of slider D using the Instantaneous center method and also compare answer with the relative velocity method for the mechanism given mechanism. **(14)**



All dimensions in mm.

Fig. 2

V b. Explain self-locking and self-energizing brakes with the help of equations. **(06)**

VI a. A cam is rotating at 600 rpm operate a reciprocating roller follower the stroke of follower is 5cm. Ascent takes place by SHM and descent by UARM. Ascent takes place by 120° and descent during 90° of cam rotation. Dwell between ascent and descent 50 degree. Determine the maximum velocity and maximum acceleration. Plot the displacement, velocity and acceleration diagram also marks salient features. **(10)**

VI b. An epi-cyclic train of gears is arranged as shown in Fig. 3. The number of teeth on the gears A and D are 40 and 90 respectively. Determine number of revolutions of the arm:If, A makes one revolution clockwise and D makes half a revolution anticlockwise. 2. If, A makes one revolution clockwise and D is stationary. **(10)**

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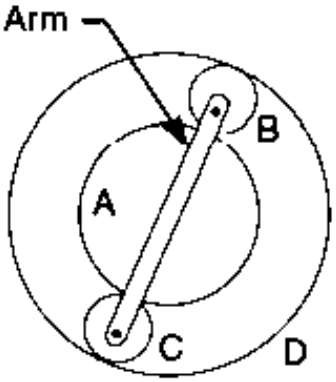

Fig.3
