Total No. of Questions : 8]

SEAT No. :

P-1578

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S.E. (Automation & Robotics/Automobile & Mechanical/Mechanical/Mechanical SW)

KINEMATICS OF MACHINERY

(2019 Pattern) (Semester-IV) (202047)

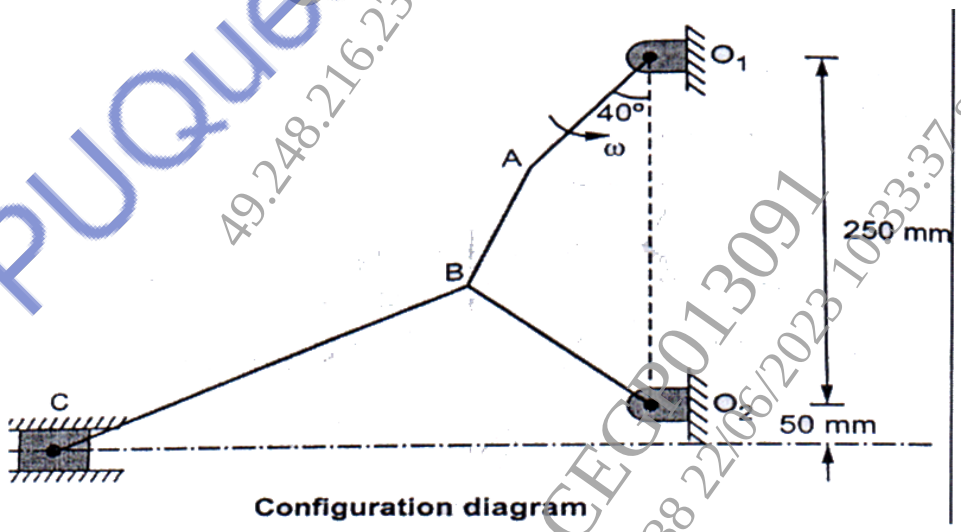
Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain acceleration image principle with neat sketch. **[5]**

b) For the mechanism as shown in fig, the length of the links are O_1A = 100mm, O_2B = 150 mm, AB = 105 mm, BC = 300 mm. Crank O_1A rotates at 180 rpm. find the acceleration of slider C using relative velocity and acceleration method. **[13]**



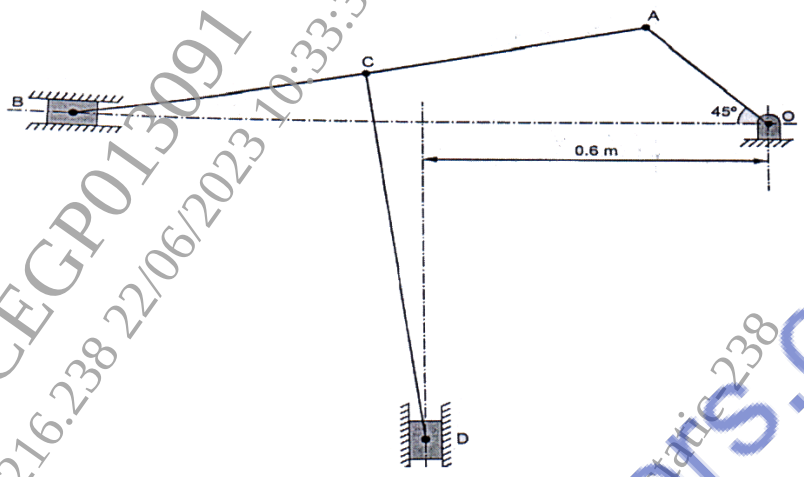
Configuration diagram

OR

Q2) a) Explain coriolis component of acceleration with neat sketch. **[5]**

P.T.O.

b) The length of various links of mechanisms as shown in fig are OA = 0.3 m, AD = 1 m, CD = 0.8 m and AC = CB. Determine for the given configuration, (i) Velocity of slider B, (ii) Velocity of slider D, (iii) Angular velocity of CD, (iv) Angular velocity of AB. If OA rotates at 60 rpm clockwise. Use ICR method. **[13]**



Q3) a) Explain 3 position relative pole method for synthesis of four bar chain mechanism. **[5]**

b) A four bar chain Mechanism is to be synthesized by using three precision points, to generate the function $y = x^{1.5}$ for the range $1<x<4$, Input link is to start from 30°and is to have range of 90°. The output link is to start at 0° and is to have range of 90°. Find out the values of x,y (Input angles) and (Output angles) corresponding to the three precision points. **[12]**

OR

Q4) a) Explain the following terms : **[6]**

i) Dimensional Synthesis

ii) Type Synthesis

iii) Number Synthesis

b) Design a four bar mechanism with input link l_2, coupler link l_3 & output link l_4. Angles θ & φ for 3 successive positions are given below. **[11]**

Position	1	2	3
θ	40°	55°	70°
φ	50°	60°	75°

If grounded link l_1 = 30mm, using frudenstein's equation, find out lengths of other links to satisfy given positional conditions. Also draw synthesize mechanism in its first position

Q5) a) Explain classification of gears along with applications of each type. **[6]**

b) Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find : **[12]**

i) The angle turned through by pinion when one pair of teeth is in mesh ; and

ii) The maximum velocity of sliding.

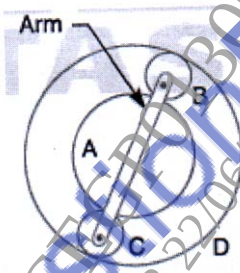
OR

Q6) a) Define in case of Spur gear : (i) Module (ii) gear ratio (iii) Addendum (iv) diametral pitch (v) contact ratio **[5]**

b) The pinions of an epicyclic train of gears is arranged as shown in Fig. How many revolutions does the arm, to which B and C are attached, make? **[13]**

i) when A makes one revolution clockwise and D makes half a revolution anticlockwise and

ii) when A makes one revolution clockwise and D is stationary. The number of teeth on the gears A and D are 40 and 90 respectively.



Q7) a) Outline how storage buffers may be deployed in automated production lines. **[5]**

b) A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below: **[12]**

1. To raise the valve through 50 mm during 120° rotation of the cam.;
2. To keep the valve fully raised through next 30°;
3. To lower the valve during next 600; and
4. To keep the valve closed during rest of the revolution i.e. 150°;

The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm.

Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft.

OR

Q8) a) Write Methods of Transfer Lines with suitable example. **[5]**

b) The following data related to a cam profile for knife edge follower, in which the follower moves with uniform acceleration and retardation during the lift and returning it with S.H.M

1. Minimum radius of cam, rb = 30 mm.
2. Lift of follower, S = 25mm.
3. Offset of follower axis, e = 6mm towards right
4. Angle of ascent, $\theta 0 = 60°$
5. Outer dwell angle, $\theta d = 45°$.
6. Angle of return, $\theta r = 75°$

Draw the cam profile. Also find maximum velocity during lift of follower and Maximum acceleration during return of follower. Cam is rotating uniformly with 250 rpm **[12]**