

Total No. of Questions : 8]

SEAT No. :

PB3710

[6261]-119

[Total No. of Pages : 4

S.E. (Mechanical/Automobile Engineering)/(Mechanical Sandwich)/  
(Automation & Robotics Engg.)/(Mechatronics Engg.)

**KINEMATICS OF MACHINERY**

(2019 Pattern) (Semester - IV) (202047)/(217547)

Time : 2½ Hours]

[Max. Marks : 70

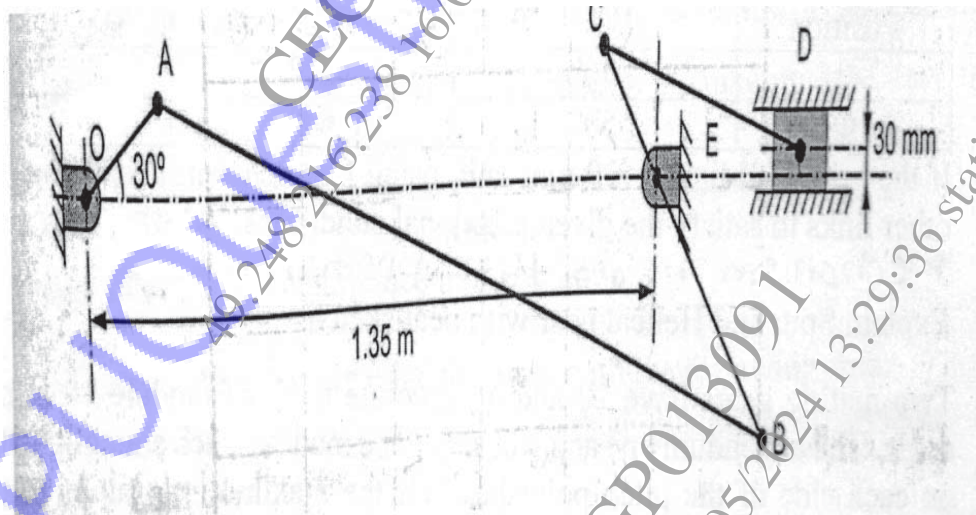
Instructions to the candidates:

- 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 With neat sketch Kennedy's theorem. [5]

b) A mechanism as shown in figure has the following dimensions:  
OA = 200 mm, AB 1500 mm, BC = 600 mm, CD = 500 mm and  
BE = 400 mm. Locate all the possible ICR by inspection, if crank OA  
rotates uniformly at 400 rpm clockwise, find [13]

- i) Velocity of B,C and D
- ii) Angular velocities of link AB, BC, CD



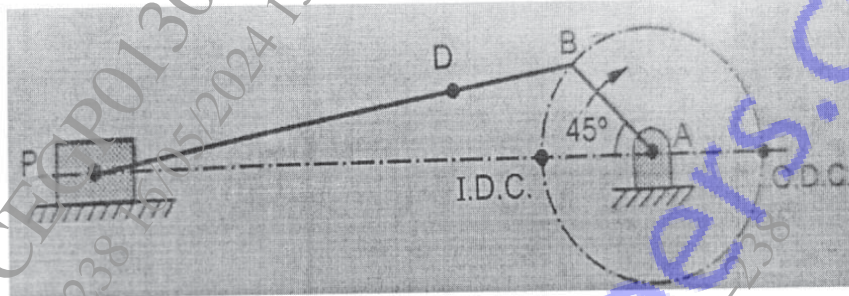
OR

Q2) a) Explain velocity image principle With neat sketch. [5]

b) The following data relate to a slider crank mechanism, crank radius  
AB = 0.50m is rotating in clockwise direction, connecting rod  
length = 2 m long, crankshaft speed = 600 rpm. When crank is turned  
45° from inner dead center (I.D.C) find, [13]

P.T.O.

- i) The velocity of piston P
- ii) The angular velocity connecting rod BP
- iii) Velocity of point D on the connecting rod which is at a distance of 0.5 m from B.
- iv) Acceleration of point D and angular acceleration of connecting rod.



**Q3) a) Explain in short [6]**

- i) Type synthesis.
  - ii) Number synthesis.
  - iii) Dimensional synthesis
- b) For function  $y = e^x$  for the range of  $0 \leq x \leq 4$  having three precision points, Determine the Chebyshev spacing using graphical approach only. Also determine the values of  $\theta$  and  $\phi$  if starting positions of  $\theta$  and  $\phi$  are  $40^\circ$  and  $50^\circ$  Also consider  $\Delta \theta = 65^\circ$  and  $\Delta \phi = 100^\circ$  required to be considered. [11]

OR

**Q4) a) Explain with neat sketches three position synthesis of four bar mechanism inversion method. [6]**

- b) Design a four-bar mechanism with input link  $l_2$ , coupler link  $l_3$ , and output link  $l_4$ . Angles  $\theta$  and  $\Phi$  for three successive positions are given below: [11]

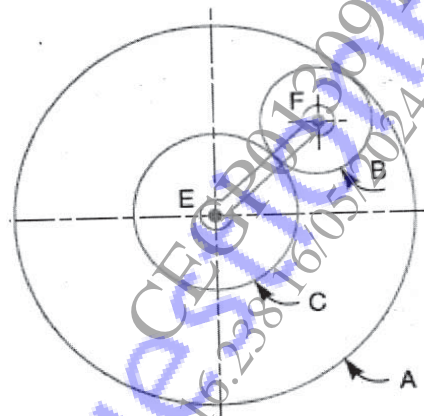
Position	1	2	3
$\theta$	$40^\circ$	$55^\circ$	$70^\circ$
$\Phi$	$50^\circ$	$60^\circ$	$75^\circ$

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

- Q5) a)** Explain Spur and Helical gear with neat sketch. [5]
- b) Two mating gears have 20 and 40 involute teeth of module 10 mm and  $20^\circ$  pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio. [12]

OR

- Q6) a)** Give comparison between Bevel gear and Worm gear. [5]
- b) An epicyclic gear train consists of three gears A, B and C as shown in fig. The number of teeth on annular gear A is 74 and on gear C is 34. The gear B meshes with both gear A and C and it is carried on an arm F which rotates about the centre A at 25 rpm. If the gear A is fixed, find the speed of gear B and C. [12]



- Q7) a)** Define automation. Why automation is important for any industry? [6]
- b) A cam operates a roller, inline reciprocating follower while rotating at 300 rpm. The further specifications are: Minimum radius of the cam = 25mm, Lift of follower = 30mm, Diameter of roller = 15mm Angle of lift =  $120^\circ$  (Nature of lift is S.H.M.), Outer dwell angle =  $30^\circ$ , Angle of return =  $150^\circ$  (Nature of return is uniform acceleration and retardation where acceleration is equal to retardation in magnitude). Draw the cam profile. [12]

OR

Q8) a) Explain concept of artificial intelligence in automation. [6]

b) A cam is to be designed for a knife edge follower with the following data: [12]

- i) Cam lift = 40 mm during  $90^\circ$  of cam rotation with simple harmonic motion.
- ii) Dwell for the next  $30^\circ$
- iii) During the next  $60^\circ$  of cam rotation, the follower returns to its original position with uniform velocity.
- iv) Dwell during the remaining,  $180^\circ$

Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

