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

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) Assume suitable data if necessary.

- Q1) a)** For the engine mechanism shown in Fig. 1. The crank OA rotates uniformly at 180 r.p.m. in clockwise direction. The various lengths are OA = 150mm; AB = 450 mm; PB = 240 mm; BC = 210 mm; CD = 660mm. **[10]**

Using relative velocity and acceleration method. Determine :

- i) Velocity of the slider D
- ii) Acceleration of the slider D
- iii) Angular acceleration of link CD

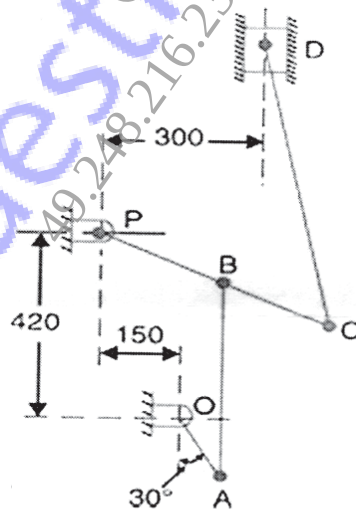


Fig.1

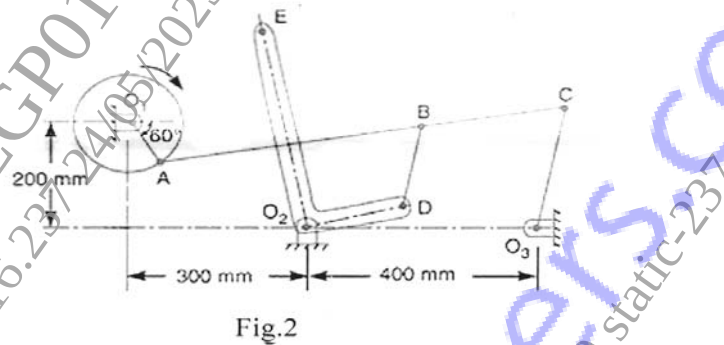
- b)** Explain Coriolis component of acceleration with neat sketch. **[7]**

OR

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Q2) a) The mechanism of a wrapping machine, as shown in Fig.2, has the following dimensions: $O_1A = 100\text{mm}$; $AC = 700\text{mm}$; $BC = 200\text{mm}$; $O_3C = 200\text{mm}$; $O_2E = 400\text{mm}$; $O_2D = 200\text{mm}$ and $BD = 150\text{mm}$. The crank O_1A rotates at a uniform speed of 100 rad/s . Find **[10]**

- Velocity of the point B
- Velocity of point D
- Velocity of point E of the bell crank lever by instantaneous Center method.



b) Explain with neat sketch Kennedy's theorem. **[7]**

Q3) a) Synthesize a four-bar mechanism using inversion method with input link and output link for 3 successive positions. Assume following data. **[10]**

- Length of the fixed link is 100 mm and input link length is 30 mm
- Initial position of input link is 30° ,
 $\theta_{12} = 30^\circ$, $\theta_{13} = 60^\circ$ (Input angle = θ)
- $\phi_{12} = 20^\circ$, $\phi_{13} = 40^\circ$ (Output angle = ϕ)

b) Explain the following terms: **[8]**

- Type synthesis
- Number synthesis
- Dimensional synthesis

OR

Q4) a) A four-bar mechanism is to be designed, by using three precision points, to generate the function $y = x^{1.5}$, for the range $1 \leq x \leq 4$. Assuming 30° starting position and 120° finishing position for the input link and 90° starting position and 180° finishing position for the output link, find the values of x , y , θ and ϕ corresponding to the three precision points. **[10]**

b) Explain the following terms: **[8]**

- Function generation
- Path generation
- Motion generation
- Structural errors

Q5) a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10mm addendum. **[10]**

find :

- i) Length of path of contact,
 - ii) Length of arc of contact,
 - iii) Contact ratio.
- b)** Define in case of Spur gear: **[7]**
- i) Module
 - ii) Addendum
 - iii) Circular Pitch
 - iv) Pressure angle
 - v) Path of contact
 - vi) Arc of Contact
 - vii) Contact ration

OR

Q6) a) In an epicyclic gear train of the 'sun and planet' type shown in Fig.3. The Annulus gear D rotates at 300 rpm about the axis of fixed sun gear B which has 80 teeth. A three-Armed spider is driven at 180rpm. Determine the number of teeth required on planet C. **[10]**

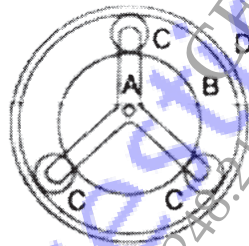


Fig.3

- b)** Define in case of helical gear. **[7]**
- i) Helix angle
 - ii) Transverse circular pitch
 - iii) Transverse module
 - iv) Normal Circular Pitch
 - v) Axial Pitch
 - vi) Lead
 - vii) Normal Module

Q7) a) A cam is to be designed for a knife edge follower with the following data: **[10]**

- i) Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.
 - ii) Dwell for the next 30°
 - iii) During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.
 - iv) Dwell during the remaining 180°
- Draw the profile of the cam when the line of stroke is offset 20mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

b) Explain with sketches the different types of cams and followers. **[8]**

OR

Q8) a) Explain **[10]**

- i) Types of automation with suitable example
- ii) Different type of transfer mechanism

b) Write Short note: **[8]**

- i) AI's Role in Manufacturing Industry
- ii) Buffer Storages.

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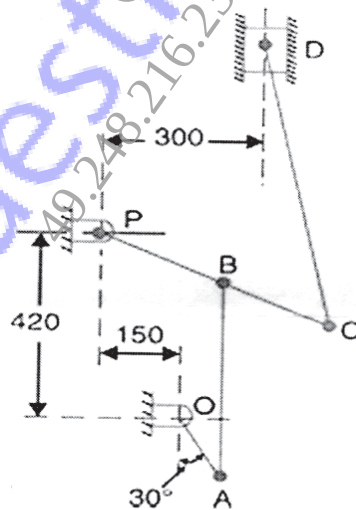


Fig.1

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