Total No. of Questions : 8]

SEAT No. :

PE4345

[Total No. of Pages : 4

[6582]-119

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

KINEMATICS OF MACHINERY

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

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Explain Velocity Image Principle with neat sketch. **[5]**

b) The dimensions of four bar chain mechanism is shown in Fig 1. in which the link AD is fixed and the crank AB rotates at uniform speed of 240 r.p.m. in clockwise direction. When the crank is at 60° with the horizontal find the angular velocity of links BC and CD and also find the angular velocity of point E of the structure BEC. **[13]**

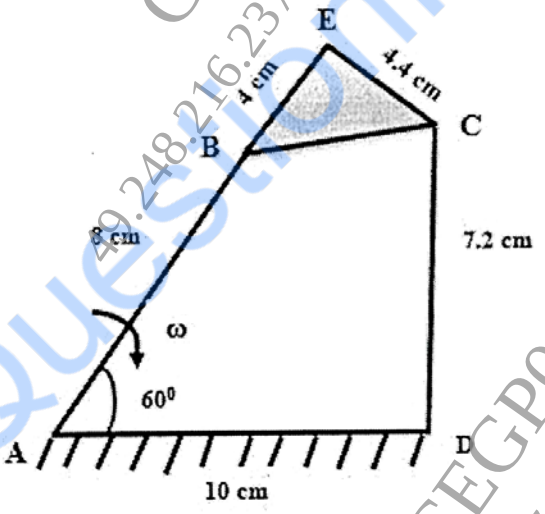


Fig1. Configuration diagram

OR

P.T.O.

Q2) a) Define rubbing velocity at a pin point. Give the formula when ω_1 & ω_2 are in same direction. **[5]**

b) In a four bar chain as shown in fig 2. AB 20 cm, BC = 30 cm, CD = 32 cm and AD = 55 cm. Crank AB rotates at a uniform speed of 200 rpm in anticlockwise direction. When the crank AB has turned 60º, locate all the instantaneous centers and find the angular velocity of link BC. **[13]**

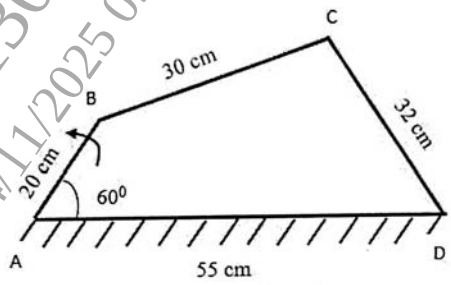


Fig. 2. Configuration Diagram

Q3) a) Explain the terms. **[6]**

i) Precision Positions

ii) Structural Error

b) Determine the Chebychev spacing for the function $y = x^{1.5}$ for the range $0 \leq x \leq 3$ where there precision points are required. For these points, determine θ_2, θ_3 and ϕ_2, ϕ_3 if $\Delta\phi = 90°$, $\Delta\theta = 40°$ **[11]**

OR

Q4) a) Explain the terms. **[6]**

i) Type Synthesis

ii) Number Synthesis

iii) Dimensional Synthesis

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

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

If grounded link l_1 = 30 mm, using Frudenstein'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) Compare the cycloid and involute gear tooth profile. **[6]**

b) Two 20º involute spur gears having module 6mm mesh externally and are to give a gear ratio of 3. **[12]**

Find:

i) No. of teeth on pinion to avoid interference on it and the corresponding number on the gear

ii) The length of contact and arc of contact

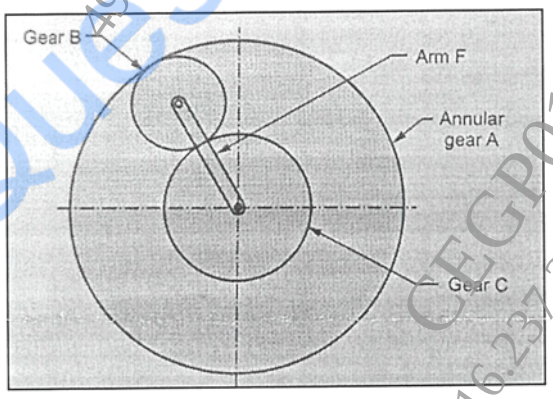
iii) The numbers of pairs of teeth in contact

iv) The maximum velocity of sliding

OR

Q6) a) State and explain terminology for helical gear with neat sketch. **[6]**

b) An epicyclic gear train consist 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) Compare different types of automation. **[5]**

b) Using the following data synthesize the cam profile operating a roller follower : **[12]**

- Motion for outstroke = SHM
- Cam rotation during outstroke = 120º
- Maximum lift of follower = 40 mm
- Offset of follower = 10 mm
- Diameter of roller = 14 mm
- Diameter of base circle = 40 mm
- Motion of return stroke = Uniform acceleration retardation
- Cam rotation during return stroke = 80º
- Angle of dwell in highest position of follower 60°.

OR

Q8) a) A cam rotation with uniform acceleration and retardation is required to give the following motion to knife edge follower: **[12]**

- The outstroke of the follower is 20 mm for 120º of cam rotation
- Dwell period for next 60º of cam rotation
- The return stroke during next 90º of cam rotation
- Dwell period for the remaining 90º of cam rotation

The minimum radius of cam is 40 mm. Draw cam profile when the line of stroke of follower is offset 15 mm from the axis of a cam.

b) Explain role of AI in manufacturing industry. **[5]**