PA-1282

[5925]-307

S.E. (Automobile & Mechanical/Mechanical/ Mechanical Sandwich/Automation & Robotics)
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 with neat sketch Kennedy's theorem. **[5]**

    b) In the mechanism shown in Fig. determine the acceleration fo the slider C. $O_1A = 100mm$, $AB = 120mm$, $O2B = 150mm$, and $BC = 350mm$. The crank O_1A rotates at 240rpm. **[13]**
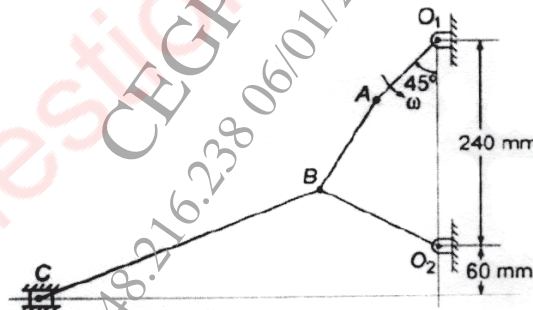

OR

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

    b) Fig shows a six link mechanism. The dimensions of links are $OA = 100$ mm, $AB = 580$ mm, $BC = 300$ mm, $QC = 100$ mm and $CD = 350$ mm. The crank OA rotates at 150rpm. For the position when crank OA makes an angle of 30º with the horizontal determine by using ICR method, Total no. of links are 6. **[13]**

P.T.O.

i) Linear velocity of points B, C and D.

ii) Angular velocity of links AB, BC and CD.
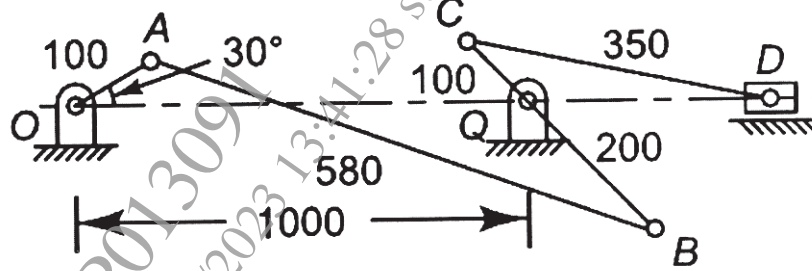
Q3) a) Explain the following terms : **[6]**

i) Type synthesis

ii) Number synthesis

iii) Dimensional synthesis

b) Determine the Chebyshev spacing for the function $y = x^{1.5}$ for the range $1 \leq \times \leq 3$ where three precision points are required. For these points, determine θ_2, θ_3 & ϕ_2, ϕ_3 if $\Delta\theta = 400$ & $\Delta\phi = 900$. **[11]**

OR

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

i) Function generation

ii) Path generation

iii) Motion generation

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 = 30mm using Freudenstein's equation, find out lenghts of other links to satify given positional conditions. Also draw synthesize mechanism in its first position & comment on the mechanism obtained.

**Q5)** a) What do you mean by interference and undercut? **[7]**
Define :
   i) Helix angle
   ii) Transverse circular pitch
   iii) Transverse module

b) A pair of spur gears with involute teeth is to a gear ratio of 4 : 1. The arc of approach is not to be less than the circular pitch and smaller wheel is the driver. The angle of pressure is 14.5°. **[11]**
Find : i) the least number of teeth that can be used on each wheel and
   ii) the addendum of the wheel in terms of the circular pitch?

OR

Q6) a) What do you understand by 'gear train'? Discuss the various types of gear trains. **[4]**

b) An epicyclic gear consists of three gears A, B and C as shown in Fig. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B anc C. **[14]**
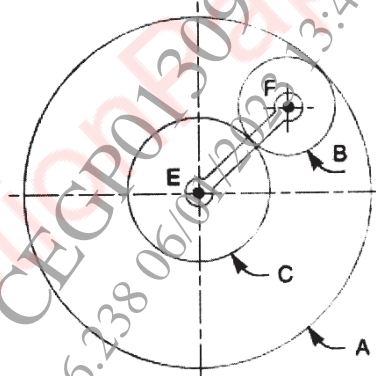
Q7) a) What are the various types of automation? Explain them. **[5]**

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

   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 remining 180°.

   The radius of the base circle of the cam is 40 mm.

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

OR

Q8) a) What are the benefits of 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 as described below. **[12]**

   i) To raise the valve through 50mm during 120º rotation of the cam;

   ii) To keep the valve fully raised through next 30º;

   iii) To lower the valve during next 60º; and

   iv) To keep the valve closed during rest of the revolution i.e. 150º;

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.