NATIONAL INSTITUTE OF TECHNOLOGY, KURUKSHETRA
THEORY EXAMINATION

B.Tech : 2nd

Paper Code : MEPC-205

Title : Kinematics of Machines

Semester: 3rd

Branch: Mechanical

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The Candidates, before starting to write the solutions, should please check the question Paper for any discrepancy, and also ensure that question paper of right course no. and right subject title is delivered..

Note: First Question is compulsory. Choose any three Question from the rest
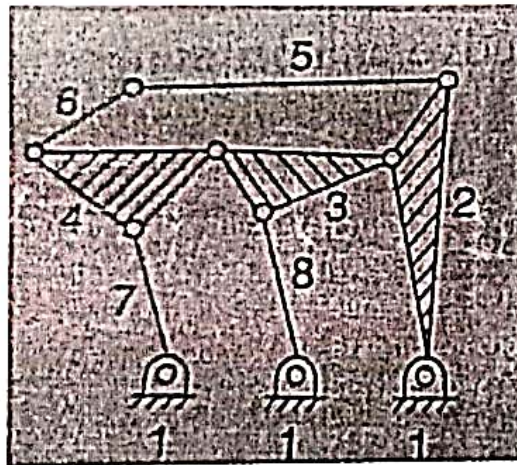
Q1(a) Find degree of freedom   (3)

FIGURE 1

(b) An Andrew variable-stroke engine mechanism is shown in Figure. The crank OA rotates at 100 rpm.
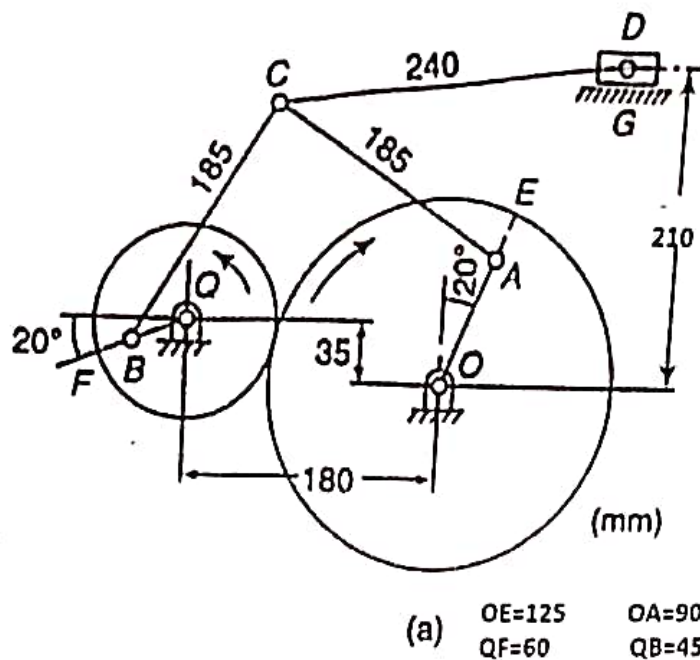
Find the

(i)   Find the linear velocities of links QF,BC,CA ,CD and of sliderD
(ii) Linear acceleration of the slider at D
(iii) Angular acceleration of the links AC,BC and CD

D

240

C

185

185

E

210

185

20°

Q

120°

A

20°

F B

35

O

180

(mm)

(a)   OE=125   OA=90
      QF=60   QB=45

(17)

Q2 Design a four-link mechanism to coordinate three positions of the input and of the output links for the following angular displacements by inversion method:

$$\theta_{12}=35° \text{ and } \varphi_{12}=50°$$

$$\theta_{13}=50° \text{ and } \varphi_{13}=80°$$

(10)

Q3 A flat faced follower mushroom follower is operated by a uniformly rotating cam. The follower is raised through a distance of 25 mm in $120°$ rotation of the cam, remains at rest for the next $30°$ and is lowered during further $120°$ rotation of the cam. The raising of the follower takes place with cycloidal motion and the lowering with uniformly acceleration and deceleration. The least radius of the cam is 25 mm which rotates at 300 rpm.

Draw the cam profile and determine the values of the maximum velocity and maximum acceleration during rising and during lowering of the follower   (10)

Q 4(a) The maximum power transmitted by a belt is 60 kW . The belt is 250 mm wide and weighs 9.81 kN/m³. If the ratio of tensions on the tight and slack sides is 2. Determine the maximum stress induced in the belt.   (6)

(b) Difference between slip and creep   (4)

OR

4 (a) A shaft has a number of collars integral with it .External diameter of collars is 400 mm and the shaft diameter is 250 mm. If the uniform intensity of pressure is $35*10^4$ N/m² and its coefficient of friction is 0.05, estimate:

(i)Power absorbed in overcoming friction when the shaft runs at 105 r.p.m and carries a load of $15*10^4$ N; and

(ii) Number of collars required   (5)

(b)The driving shaft of a Hooke's joint rotates at a uniform speed of 400 rpm. If the maximum variation in speed of the driven shaft is ±5 % of the mean speed, Determine the greatest permissible angle between the axes of the shafts . What are the maximum and minimum speeds of shaft.   (5)