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10ME/AU44

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Kinematics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define the following:
(i) Kinematic pair (ii) Kinematic chain. (iii) Mechanism. (iv) Inversion. **(04 Marks)**

b. Differentiate between the following:
(i) Higher pair and Lower pair. (ii) Machine and structure.
(iii) Kinematic chain and mechanism. (iv) Mechanism and Machine. **(12 Marks)**

c. Explain the following with examples :
(i) Completely constrained motion (ii) Successfully constrained motion. **(04 Marks)**

2 a. List all the inversions of a single slider Crank Chain and explain any one of them, with a neat sketch. **(06 Marks)**

b. List all the inversions of a double slider crank chain and explain any one of them with a neat sketch. **(06 Marks)**

c. Explain with a neat sketch, the working of Peaucellier mechanism and prove that it produces an exact straight line motion. **(08 Marks)**

3 a. Write a note on: (i) Velocity image
(ii) Coriolis component of acceleration. **(06 Marks)**

b. For the configuration of a slider crank mechanism shown in Fig. Q3 (b), find (i) Acceleration of Slider 'B' (ii) Angular acceleration of 'AB' (iii) Acceleration of point 'E'. The Crank rotates at 180 rpm. The lengths of links are OA = 150 mm, AB = 500 mm and AE = 250 mm. **(14 Marks)**

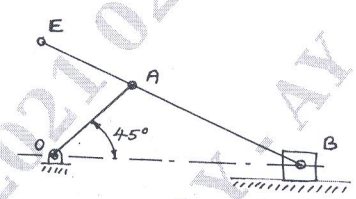
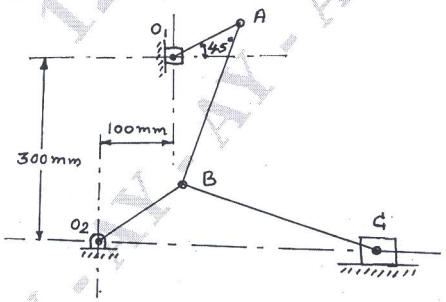


Fig. Q3 (b)

4 a. Locate all the instantaneous centres of rotation for the toggle mechanism shown in Fig.Q4 (a). The crank rotates at 240 rpm. Determine
(i) Velocity of the slider 'C' and
(ii) Angular velocity of Link 'AB'. **(12 Marks)**



O_1A = 200 mm
AB = 360 mm
O_2B = 200 mm
BC = 525 mm

Fig. Q4 (a)

b. Determine the acceleration of the piston and angular acceleration of the connecting rod for the following specification by Klein's construction.
Stroke of piston = 600 mm
Ratio of connecting rod to crank length = 4
Speed of engine = 300 rpm
Position of the crank = 60° from inner dead centre. **(08 Marks)**

PART – B

5 a. Obtain the loop closure equation for a fourbar mechanism. **(05 Marks)**

b. Develop the equations for the angular velocities and angular accelerations for the links 3 and 4, of the fourbar mechanism shown in Fig. Q5 (b) using complex algebra method (Raverin Approach). **(15 Marks)**

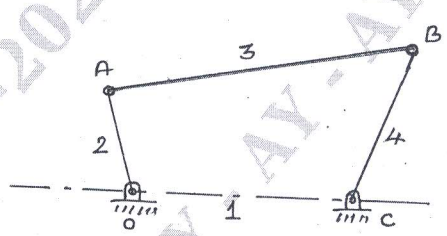


Fig. Q5 (b)

6 a. Write a note on:
(i) Interference
(ii) Cycloidal gear tooth. **(06 Marks)**

b. State and prove law of gearing. **(08 Marks)**

c. 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 10 mm addendum. Find the length of parth of contact, arc of contact and contact ratio. **(06 Marks)**

7 a. Sketch and explain different types of gear trains. **(08 Marks)**

b. In an epicyclic gear train of sun and planet type, the pitch circle diameter of the annular wheel in 425 mm and the module is 5 mm. When the annular wheel is stationary the spider which carries 3 planet gears of equal size has to make one revolution for every revolution of the driving spindle carrying sun wheel. Determine the number of teeth on all the wheels. **(12 Marks)**

8 a. Briefly explain the different types of followers commonly used. **(06 Marks)**

b. A Cam having a base circle radius of 40 mm is to be designed to drive a knife edgest follower with the following data:
(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° 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. **(14 Marks)**

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