INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

B.Tech IV Semester End Examinations (Supplementary) - July, 2018

Regulation: IARE – R16

KINEMATICS OF MACHINERY

Time: 3 Hours   **(ME)**   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) What is the significance of degrees of freedom of a kinematic chain when it functions as a mechanism? Give example of a chain with 2 DOF. With a neat diagram, explain the concept of crank and slotted lever quick return motion mechanism. **[7M]**

   (b) Apply the Grubler's criterion to the machine shown in Figure 1 and check the mobility. **[7M]**
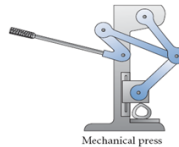

Mechanical press

Figure 1

2. (a) With neat sketches, explain inversions of double slider crank chain. **[7M]**

   (b) In a Whitworth quick return motion mechanism, the distance between fixed centres is 50 mm and length of the driving crank is 75 mm. The length of the slotted lever is 150 mm, length of connecting rod is 135 mm. The driving crank making 30^0 angle with the horizontal. Find the ratio of time of cutting stroke to return stroke and effective stroke length. **[7M]**

UNIT – II

3. (a) Describe a method of locating instantaneous centers of a four bar mechanism. **[7M]**

   (b) The crank and connecting rod of a slider crank mechanism are 100 mm and 300 mm respectively. The crank has a speed of 75rad/sec in the clockwise direction and an angular acceleration of 1200 rad/sec^2. When crank rotated for 120^0 from its I.D.C. , find velocity and acceleration of a point G on the connecting rod 200 mm from the slider **[7M]**

4. (a) Explain the rules to locate permanent and fixed Instantaneous centres **[7M]**

   (b) Derive an expression for the magnitude and direction of coriolis component of acceleration **[7M]**

UNIT – III

5. (a) With a sketch, explain any one exact straight line motion mechanism consisting of one sliding pair. Explain the difference between Ackerman and Davis steering gear mechanisms **[7M]**

   (b) A double universal joint is used to connect two shafts in the same plane. The intermediate shaft is inclined at an angle of 20^0 to the driving shaft as well as the driven shaft. Find the maximum and minimum speed of the intermediate shaft and the driven shaft if the driving shaft has a speed of 500 r.p.m. **[7M]**

6. (a) With a sketch, explain the Roberts mechanism. Prove that a Hart's mechanism generate a locus of exact straight line. **[7M]**

   (b) In a Davis steering gear, the distance between the pivots of the front axle is 1 metre and the wheel base is 2.5 metres. Find the inclination of the track arm to the longitudinal axis of the car, when it is moving along a straight path. **[7M]**

UNIT – IV

7. (a) Classify the followers based on motion and path of motion of the follower. **[7M]**

   (b) A disc cam rotating with 100 rpm. It is operating a follower for a lift of 50mm. The outward motion for 120^0 with SHM and return for 90^0 with uniform acceleration and retardation. Represent the velocity and acceleration diagrams of follower. **[7M]**

8. (a) Derive the relations for velocity and acceleration of the follower for a circular arc cam with straight faced follower when the flat face of the follower has contact on the nose. **[7M]**

   (b) A symmetrical tangent cam operating a roller follower, the last radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75^0 and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate **[7M]**

   i. The principal dimensions of the cam

   ii. The acceleration of the follower at the beginning of the lift

UNIT – V

9. (a) Derive the condition for minimum number of teeth on the wheel in order to avoid interference. **[7M]**

   (b) A pair of gears, having 40 and 20 teeth respectively, is rotating in mesh, the speed of the smaller being 2000 rpm. Determine the velocity of sliding between the gear teeth faces at the point engagement. The gear teeth having 20^0 pressure angle , module is 5 mm and addendum is one module **[7M]**

10. (a) Derive the velocity ratio of simple gear train with 4 gears **[7M]**

 (b) In the gear train shown in Figure 2, the various gear teeth are Fixed internal wheel c has 82 teeth. D has 28 teeth and B has 80 teeth. Arm making 500 rpm. Find the speed of gear B.
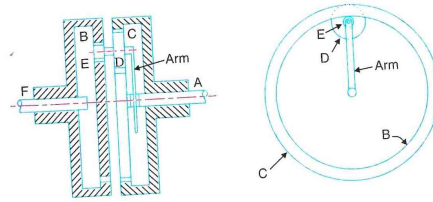
[7M]

Figure 2

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