INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
B.Tech IV Semester End Examinations (Regular / Supplementary) - May, 2019
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) Define machine and mechanism. Enumerate the inversions of single slider crank chain mechanism. **[7M]**

   (b) "There are various ways of classifying kinematic pairs". Elaborate with examples mentioning DOF of each pair. **[7M]**

2. (a) Sketch and explain the various inversions of a double slider crank chain. **[7M]**

   (b) The Whitworth quick return motion mechanism has the driving crank 120 mm long. The distance between fixed centre is 80 mm. The line of stroke of the ram passes through the centre of rotation of the slotted lever whose free end is connected to the ram by a connecting link. Find the ratio of time of cutting to time of return. **[7M]**

UNIT – II

3. (a) Identify the location of instantaneous centre of a body rolling with sliding on a stationary curved surface. **[7M]**

   (b) The crank of a slider crank mechanisms rotates clockwise at a constant speed of 600 rpm. The crank is 125 mm and connecting rod is 500 mm long. Determine

   i. Linear velocity and acceleration of the mid Point of the connecting rod.

   ii. Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45^0 from inner dead centre position. **[7M]**

4. (a) Mention different types of instantaneous centers. Locate the instantaneous centers for crank and slotted lever quick return mechanism? **[7M]**

   (b) In a pin jointed four bar mechanism, as shown in Figure 1; AB = 300 mm, AD = 600 mm, and BC = CD = 360 mm. The angle BAD = 60^0. The crank AB rotates uniformly at 100 rpm. Locate all the instantaneous centre and find the angular velocity of the link BC. **[7M]**
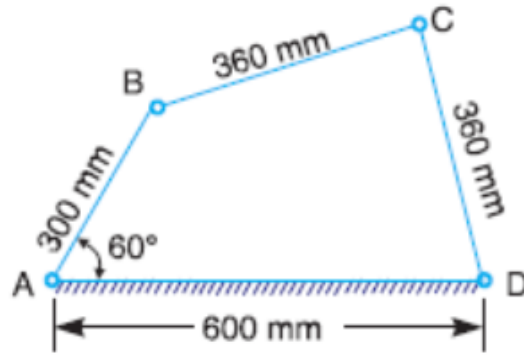
Figure 1

UNIT – III

5. (a) Elucidate the Peaucellier mechanism and show that it generates straight-line motion.   **[7M]**

    (b) Two shafts are to be connected by a Hooke's joint. The driving shaft rotates at a uniform speed of 500 rpm. Determine the greatest permissible angle between the shaft axes so that the total fluctuation of speed does not exceed 50 rpm. Also calculate the maximum and minimum speeds of the driven shaft.   **[7M]**

6. (a) Explain why two Hooke's joints are used to transmit motion from the engine to the differential of an automobile.   **[7M]**

    (b) The driving shaft of a Hooke's joint runs at a uniform speed of 240 rpm. and the angle α between the shafts is 20°. The driven shaft with attached masses has a mass of 55 kg at a radius of gyration of 150 mm.

    i) If a steady torque of 200 N-m resists rotation of the driven shaft, find the torque required at the driving shaft, when $\theta = 45°$

    ii) At what value of α will the total fluctuation of speed of the driven shaft be limited to 24 rpm?   **[7M]**

UNIT – IV

7. (a) Define a cam and mention the types? What are the various motions possible with cam and follower?   **[7M]**

    (b) Draw the cam profile of a cam operating a roller follower with radius of 15mm has the following data Follower moves outwards through 40mm during 90^0 of cam rotation. Follower dwells for the next 45^0. Follower returns of its original position during next 90^0. Follower dwells for the rest of the rotation. The displacement of the follower is to take place with SHM during the outward and uniform velocity motion during the return strokes. The least radius of the cam is 50mm.   **[7M]**

8. (a) Draw and explain the displacement and velocity diagrams for simple harmonic motion.   **[7M]**

    (b) Lay out the profile of a cam so that the follower is to move outwards through 30 mm during 160^0 of cam rotation with Uniform velocity and dwell for 30^0 of cam rotation followed by returning to initial position with uniform acceleration and retardation during 110^0 of cam rotation and dwell for the remaining period. The base circle diameter of cam is 28mm and the follower is a knife edge follower. The axis of the follower is passing through the axis of cam.   **[7M]**

UNIT – V

9. (a) Describe how the velocity ratio of epicyclic gear train is obtained by tabular method **[7M]**

   (b) Find the length of the path of contact, arc of contact and contact ratio when pinion with 18 teeth meshes with an internally toothed wheel with 72 teeth, when the pressure angle is 20^0, module is 4 mm. **[7M]**

10. (a) What do you understand by 'gear train'? Discuss the various types of gear trains. **[7M]**

    (b) Figure 2 below shows a planetary gear train. Gears 2, 4 and 5 have 24, 40 and 144 teeth respectively. Gear 5 is fixed. Gear 2 is rotating clockwise at 700 rpm. Determine the speed of the arm and gear 4. **[7M]**
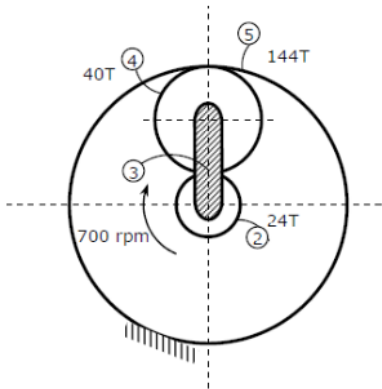

Figure 2

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