Hall Ticket No | | | | | | | | | | |  Question Paper Code: AMEB10

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

B.Tech IV Semester End Examinations (Regular/Supplementary) - July, 2021

**Regulation: R18**

## KINEMATICS OF MACHINES

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

**Answer FIVE Questions choosing ONE question from each module**
**(NOTE: Provision is given to answer TWO questions from any ONE module)**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### MODULE – I

1. (a) What is the inversion of single slider crank chain? Explain any two with neat sketch. **[7M]**

   (b) A crank and slotted lever mechanism used in a shaper has a centre distance of 300 mm between the centre of oscillation of the slotted lever and the centre of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to the time of return stroke. **[7M]**

2. (a) Explain the different types of constrained motion with neat sketch. **[7M]**

   (b) Explain Grubler's criterion for determining degree of freedom for mechanisms. Using Grubler's criterion for plane mechanism, prove that the minimum number of binary links in a constrained mechanism with simple hinges is four. **[7M]**

### MODULE – II

3. (a) Describe quick return motion mechanism of shaper, how the coriolis component of the acceleration can be calculated with suitable sketch. **[7M]**

   (b) The Crank of a slider crank mechanisms rotates clockwise at a constant speed of 600 r.p.m. The crank is 125 mm and connecting rod is 500 mm long. Show the

   i) Linear velocity and acceleration of the mid point of the connecting rod, and

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

4. (a) What are the various methods for determining the velocity of a point on a link in the mechanism? Explain anyone method with neat sketch. **[7M]**

   (b) In a pin jointed four bar mechanism, as shown in Figure 1, AB = 300 mm, BC = CD = 360mm, and AD = 600 mm. The angle BAD = 60°. The crank AB rotates uniformly at 100rpm. Locate all the instantaneous centres.

   **[7M]**

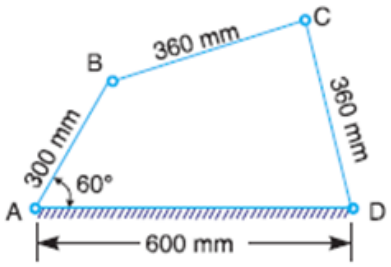


Figure 1

## MODULE – III

5. (a) Describe the Watt's parallel mechanism for straight line motion and derive the condition under which the straight line is traced. **[7M]**

   (b) Derive an expression for the ratio of shafts velocities for Hooke's joint and draw the polar diagram depicting the salient features of driven shaft speed **[7M]**

6. (a) Explain working of pantograph with neat sketch and show that it can be used to reproduce to an enlarged scale. **[7M]**

   (b) Two shafts with an included angle of 160° are connected by a Hooke's joint. The driving shaft runs at a uniform speed of 1500rpm. The driven shaft carries a flywheel of mass 12 kg and 100 mm radius of gyration. Find the maximum angular acceleration of the driven shaft and the maximum torque required. **[7M]**

## MODULE – IV

7. (a) Explain with a neat sketch the different types of cams and followers. **[7M]**

   (b) A symmetrical circular cam operating a flat-faced follower has the following particulars :
   Minimum radius of the cam = 30 mm ;
   Total lift = 20 mm ; Angle of lift = 75° ;
   Nose radius= 5 mm;
   Speed = 600rpm. Determine the principal dimensions of the cam. **[7M]**

8. (a) Derive the expressions for displacement, velocity and acceleration for a circular arc cam operating a flat-faced follower when the contact is on the circular flank. **[7M]**

   (b) A cam is to be designed for a knife edge 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° of cam rotation, the follower returns to its original position with simple harmonic motion.
   iv) Dwell during the remaining 180°.
   Draw the displacement diagram of the cam. **[7M]**

## MODULE – V

9. (a) State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing. **[7M]**

(b) The following data relate to a pair of 20° involute gears in mesh : Module = 6 mm, Number of teeth on pinion = 17, Number of teeth on gear = 49; Addenda on pinion and gear wheel = 1 module. Find :

i) The number of pairs of teeth in contact ;

ii) The angle turned through by the pinion and the gear wheel when one pair of teeth is in contact. **[7M]**

10. (a) Illustrate how reverted gear train is working with simple sketches. **[7M]**

(b) In a reverted epicyclic gear train as shown in Figure 2, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100rpm clockwise.

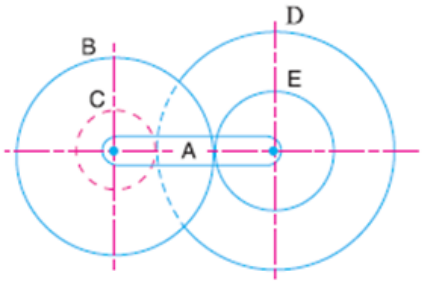


Figure 2

**[7M]**

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