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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, APRIL/MAY 2018

*Branch: MECHANICAL ENGINEERING*

*Stream(s): MACHINE DESIGN*

*Course Code & Name:* 01ME6102, ADVANCED THEORY OF MECHANISMS

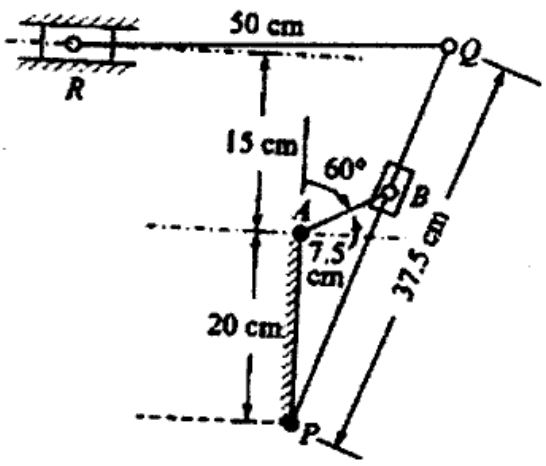
Answer *any two full* questions from *each* part

Limit answers to the required points.

Max. Marks: 60 Duration: 3 hours

**PART A (Module I & II)**

1. a. For the mechanism shown below, the velocity of point B is 10 m/s (constant). Determine the velocity of different links (4 marks)




b. Determine the coriolis component of acceleration for the mechanism. (1 mark)

c. Determine the acceleration of different links. (4 marks)

2. a. Sketch any complex mechanism & explain why the mechanism is complex. (2 marks)

b. Derive the velocity and acceleration relationships for a slider crank mechanism using vector approach. (5 marks)

c. Explain inflection circle. (2 marks)

3. a. Derive the equation for the cubic of stationary curvature. (7 marks)

b. Discuss the situations where first and second Bobillier constructions are useful. (2 marks)

## PART B (Module III &IV)

4. a. Derive the equation for the coupler curve. ( 6 marks)

   b. Show that the coupler curve has multiple points at each of its intersections with the circle of foci. ( 2 marks)

   c. Explain double points. (1 marks)

5. a. Explain Roberts Chebychev theorem. Draw a 6 bar and 5 bar cognates to a four bar mechanism. (5 marks)

   b. Derive the equation for the contact force of an eccentric cam. (4 marks)

6. a. Explain cross over shock ( 1 marks)

   b. Explain wind up in cams. ( 1 marks)

   c. A dwell rise cam has a rise of 30 mm and moves with cycloid motion for 130 $^0$ cam rotation. The follower is assembled with a retaining spring with necessary pre compression. The stiffness of the spring is 50 N/mm. The equivalent mass and stiffness of the follower train are 0. 3 kg and 75 N/mm respectively. Determine the follower response when the cam rotates at 3000 r.p.m.

   ( 7 marks)

## PART C (Module V & VI)

7. a. Design a double lever mechanism to obtain the following input and output coordination. Input angles $\theta_{12}$ =45 $^0$ cw, $\theta_{13}$ =80 $^0$ cw and $\theta_{14}$ =110 $^0$ cw and output angles $\Phi_{12}$ =30 $^0$ cw, $\Phi_{13}$ =40 $^0$ cw, $\Phi_{14}$ =50 $^0$ cw. Take fixed frame length as 75 mm.

   ( 9 marks)

   b. Show the different positions of the above designed mechanism with required coordination. ( 3 marks)

8. a. Derive the equation for the kinetic energy of rigid body in 3 dimension.

   ( 6 marks)

   b. Explain gyroscopic effect. What are the applications of this effect? Mention the places where its effect is to be considered seriously. (3 marks)

   c. What is steady precession of a gyroscope? Explain how the crushing force in a crushing mill is magnified. (3 marks)

9. a. Derive the equation for the angular momentum of a rigid body in 3 dimensions. ( 6 marks)

   b. Derive the scalar equations for the rotation of a rigid body about a fixed axis.

   ( 3 marks)

   c. Explain the principle of impulse and momentum for the plane motion of a rigid body.

   ( 3 marks)