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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M. TECH DEGREE EXAMINATION, JUNE/JULY 2018

Branch: Mechanical Engineering

Stream(s) - Machine Design

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

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

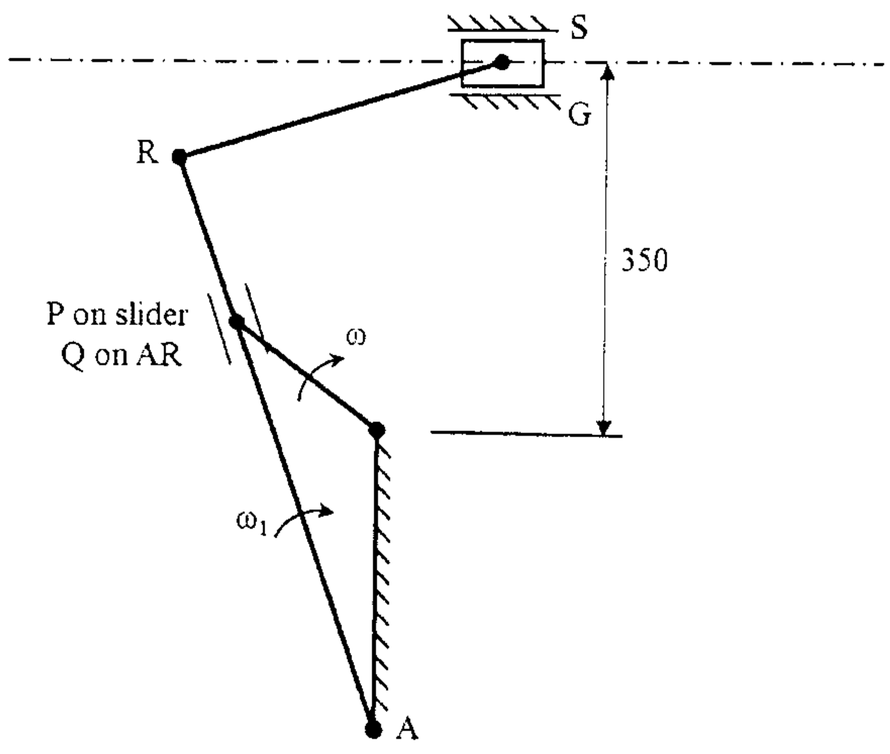
Limit answers to the required points.

Max. Marks: 60

Duration: 3 hours

PART A

1. A quick return mechanism of the slotted lever type, the various dimensions of which are OA = 400 mm, OP= 200 mm, AR = 700 mm, RS = 300 mm. The crank OP rotates at 210 rpm.



a. Draw the velocity diagram of this mechanism. (2)

b. Determine the velocity of the cutting tool at S and angular velocity of the link RS (3)

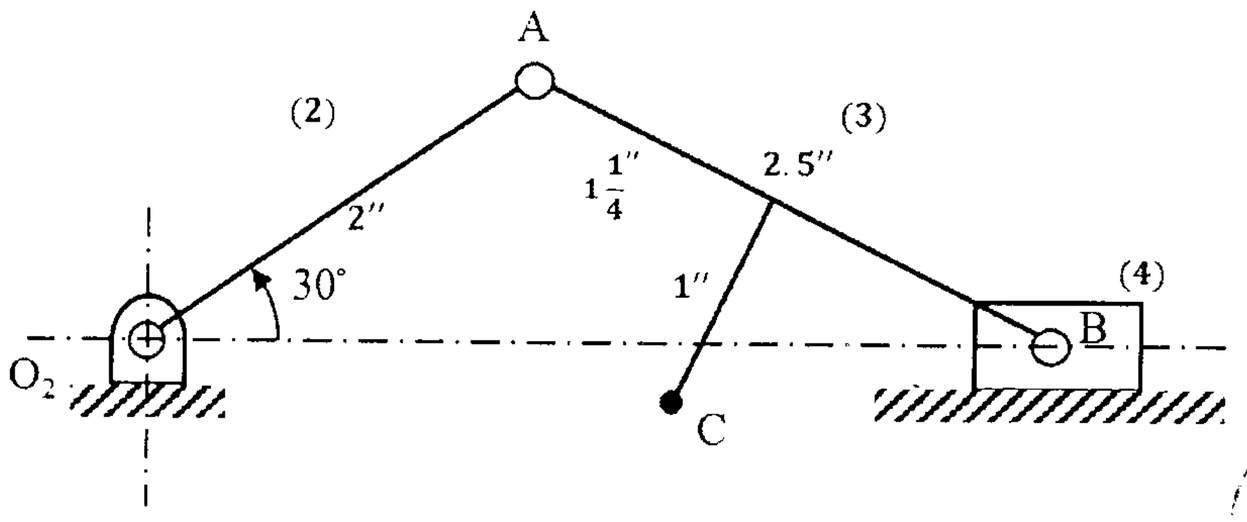
c. Determine the angular acceleration of the link RS (4)

2. a. Describe the fixed centrode and the moving centrode with figures. (2)

b. Explain Hartmann construction with a neat figure. (3)

c. Explain inflection circle. Write down the two forms of Euler-Savary equation. (4)

3. a. Find the inflection circle for the motion of the coupler of the slider-crank linkage and determine the instantaneous radius of curvature of the path of the coupler point C. (Dimensions are in inches) (6)



b. State Bobillier Theorem and explain it with a neat figure (3)

PART B

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

b. Explain circle of foci, multiple points, imaginary points and asymptote. (3)

5. a. Explain cusp, crunode and symmetry. (2)

b. Derive the equation for the contact force and jump speed of an eccentric cam. (5)

c. Prove that jump will not occur if the preload $P > e(m\omega^2-2k)$ (2)

6. a. Explain Johnson's Numerical Analysis. (4)

b. Explain spring surge, unbalance and wind up. (2)

c. Write down the displacement curves of cams. Describe any two in detail. (3)

PART C

7. a. Write down the properties of pole points in a four-bar mechanism. Describe Relative pole. (3)

b. Design a slider crank mechanism. Eccentricity 'e' of the crank above the fixed pivot is 10 mm, crank angle $\theta_{12} = 45^\circ$ CW, slider displacement $S_{12} = 40$ mm, slider moving away from fixed point. (5)

c. Design a four-bar mechanism with input crank $\theta_{12} = 60^\circ$ CW and output with $\phi_{12} = 40^\circ$ CW, fixed link length is 60 mm. (4)

8. a. Obtain Freudenstein's equation for four bar mechanism. (3)

b. Design a four bar mechanism, the motions of input & output links are governed by a function $y = x^2$ and x- varies from 0 to 2 with an interval of 1. Assume θ_2 vary from 50° to 150° and ϕ_2 vary from 80° to 160°. (4)

c. Determine Chebyshev spacing for the function $2x^2-2$, in the range of $0 < x < 2$, where three accuracy point are required. At the above precision points determine the crank angles for $\theta_0 = 30^\circ$, $\Delta\theta = 45^\circ$, $\phi_0=60^\circ$, $\Delta\phi=90^\circ$. (5)

9. a. State Grashof's Law. Determine the minimum and maximum transmission angles for the four-bar mechanism. (3)

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

c. Write down the Euler's equation of motion (3)