

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Fifth Semester B.Tech Degree Regular and Supplementary Examination December 2020

**Course Code: ME301****Course Name: MECHANICS OF MACHINERY**

Max. Marks: 100

Duration: 3 Hours

**PART A***Answer any three full questions, each carries 10 marks.*

Marks

- |   |  |        |
|---|--|--------|
| 1 | Explain with neat sketch, an application each of the four inversions of slider crank mechanism.  | 10     |
| 2 | In a four-link mechanism, the crank AB rotates at 36 rad/s. the lengths of the links are AB = 200mm, BC = 400mm, CD = 450mm and AD = 600mm. AD is the fixed link. At the instant when AB is at right angles to AD, determine the velocity of the midpoint of link BC.  | 10     |
| 3 | In a single slider crank mechanism, the lengths of the crank and connecting rod are 300 mm and 400 mm respectively. The slider is positioned in line to the crank axis at a distance of 500 mm. At a particular instant, the crank is inclined at $110^\circ$ with the line of motion of the slider. It is rotating with an angular velocity of 70 rad/s and angular acceleration $900 \text{ rad/s}^2$ in the clockwise direction. Compute the acceleration of the slider and angular acceleration of the connecting rod. | 10     |
| 4 | a) Sketch the displacement, velocity, acceleration and jerk diagrams of a cam follower which moves with cycloidal motion.<br>b) List the different types of cams based on their shape? Sketch any one type of cam.   | 4<br>6 |

**PART B***Answer any three full questions, each carries 10 marks.*

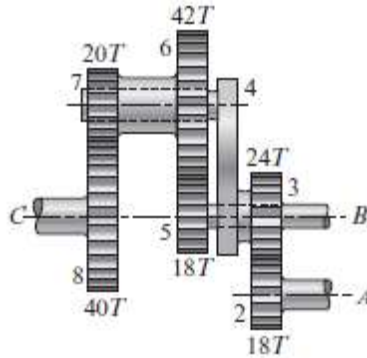
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|---|---|--------|
| 5 | Design a cam profile as per the data given;<br>a) The least radius of the cam is 30 mm.<br>b) The cam is rotating a speed of 1600 rpm counter clockwise.<br>c) The axis of the knife edge follower is offset by 10 mm to the left.<br>d) The follower is provided a maximum lift of 40 mm during $160^\circ$ of the cam rotation subjected to constant acceleration and deceleration.<br>e) Dwell for the $40^\circ$ rotation of the cam.<br>f) Drop of the follower for the next $100^\circ$ rotation of the cam with SHM and followed by dwell. | 10     |
| 6 | a) Explain tangent cam with neat sketch.<br>b) Obtain the condition for minimum acceleration for a tangent cam with roller follower, when the roller is on the flank.   | 3<br>7 |
| 7 | a) State and prove the law of gearing.  | 5      |

- b) Distinguish between the cycloid and involute forms of gear teeth. 5
- 8 Derive an expression for the minimum number of teeth in an involute profile gear. 10

**PART C**

*Answer any four full questions, each carries 10 marks.*

- 9 In the given gear train, the shaft B is stationary and shaft C is driven at 380 rpm in the counter clockwise direction. Determine the speed and direction of rotation of shaft A. 10



- 10 a) Sketch a reverted gear train and epicyclic gear train. 4
- b) Establish the relation between speed ratio and train value of a simple gear train. 6
- 11 a) Discuss the method of determining the angles for input and output link in a four-bar mechanism for function generation with an example. 5
- b) The motions of the input and output links are related by the equation  $y = x^2$ . The range of  $x$  is from 1 to 4. Find  $x$  and  $y$  values using Chebychev spacing for five precision points. 5
- 12 In a slider crank mechanism, for the three position coordination, the angular displacements of the crank are  $40^\circ$  and  $100^\circ$ . The respective linear displacements of the slider are 120 mm and 220 mm. The eccentricity of the slider is 20 mm. Design the mechanism graphically. 10
- 13 Synthesize a four-bar mechanism to guide a rod (coupler) AB through three consecutive positions  $A_1B_1$ ,  $A_2B_2$  and  $A_3B_3$  as follows. 10  
 $A_1(3,0)$ ,  $B_1(3,5)$ ,  $A_2(11,7)$ ,  $B_2(6,7)$ ,  $A_3(5,2)$  and  $B_3(8,6)$
- 14 The motions of the input and output links of a four-bar mechanism are governed by the function  $y = 3x^2$ . The  $x$  varies from 1 to 3 with an interval of 1. Assume the input angle varies from  $30^\circ$  to  $110^\circ$  and output angle varies from  $70^\circ$  to  $130^\circ$ . Synthesize the mechanism using Freudenstien's equation. 10

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