

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019**

**Course Code: ME301**

**Course Name: MECHANICS OF MACHINERY**

Max. Marks: 100

Duration: 3 Hours

**PART A**

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

Marks

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|---|---|-----|
| 1 | a) What is kinematic chain? State the conditions required for a kinematic chain to execute constrained motion.  | (3) |
|   | b) Sketch the Peaucellier straight line motion mechanism and prove that the tracing point describes a straight line path.   | (7) |
| 2 | a) Differentiate between a machine and structure  | (2) |
|   | b) What is meant by inversion of a mechanism? Describe with suitable sketches the inversions of a double slider- crank chain.   | (8) |
| 3 | a) Sketch the displacement, velocity and acceleration diagrams of a cam follower which moves with cycloidal motion.   | (4) |
|   | b) When will Corioli's component of acceleration come into play in a mechanism? Derive the formula for Coriolis's acceleration. Suggest a procedure to find the direction of Coriolis's acceleration.                                 | (6) |
| 4 | a) Compare the performance of knife edge, roller and mushroom cam follower.   | (4) |
|   | b) If the crank and connecting rod of a slider crank mechanism are 150mm and 1m respectively and the crank rotates at 200rpm, determine (i) the crank angle at which the maximum velocity occurs (ii) maximum velocity of the piston. | (6) |

**PART B**

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

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|---|---|-----|
| 5 | a) Define polynomial cam. What are its advantages?  | (3) |
|   | b) A flat faced follower is operated by a symmetrical circular cam with the straight line path of the follower passing through the cam axis. The least diameter of the cam is 40mm, lift is 12mm, total angle of action is $160^\circ$ . The cam rotates at 500rpm. If the period of acceleration is 60% of the retardation during lift, determine (i) the main dimensions of the cam. (ii) maximum acceleration and retardation during the lift. | (7) |
| 6 | a) What is pressure angle of a cam? Discuss its importance in cam design.   | (2) |

- b) A cam with 25mm minimum radius is rotating clockwise at 480 rpm to give the follower motion to a roller of 20mm diameter. Lift = 40mm, follower rises during  $120^\circ$  of cam rotation, dwells for  $45^\circ$  of cam rotation, follower to return during  $150^\circ$  of cam rotation and the follower dwells for the remaining period. The rise and return of the follower takes place with cycloidal motion. The line of stroke of the follower is offset by 10mm from the center of the cam. Construct the cam profile and determine the maximum velocity and acceleration during rise and return stroke. (8)
- 7 a) What are the main gear tooth profiles that satisfy the law of gearing? Compare them. (4)
- b) Two involute spur gears with pressure angle  $20^\circ$  have a velocity ratio of 3. The module is 3mm and the addendum is equal to 1.1 module. If the pinion rotates at 120rpm, determine the minimum number of teeth on each wheel to avoid interference and the contact ratio. (6)

- 8 a) What is interference in involute gears? What are the various methods used to avoid interference? (4)
- b) State and derive the law of gearing. (6)

### PART C

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

- 9 a) Explain the functioning of a reverted gear train? Derive its velocity ratio. (4)
- b) An epicyclic gear train consists of a pinion, a wheel of 40 teeth and an annulus with 84 internal teeth concentric with the wheel. The pinion meshes with the wheel and the annulus. The arm that carries the axis of the pinion rotates at 100rpm. (i) If the annulus is fixed find the speed of the wheel. (ii) If the wheel is fixed find the speed of the annulus. (6)
- 10 a) List the various types of gear trains and their applications. (3)
- b) Explain with neat sketch the working of differential. (7)
- 11 a) What are precision points? Explain the Chebyshev spacing of precision points. (4)
- b) Define kinematic synthesis. Explain the various steps involved in kinematic synthesis? (6)
- 12 a) Explain the graphical method for obtaining precision points. (3)
- b) Explain 2 position and 3 position synthesis of a four bar mechanism by assuming suitable dimensions. (7)
- 13 a) What are coupler curves? Explain their role in synthesis. (2)

- b) Design a four bar mechanism to generate the function  $y=2x^2$  where  $x$  varies from 2 to 4 with an interval of 1. Assume input angle to vary from  $40^\circ$  to  $120^\circ$  and output angle to vary from  $60^\circ$  to  $132^\circ$ . The length of fixed link is 1m. (8)
- 14 a) Define the following terms (a) Limit positions (b) Dead centers (c) Function generator (d) Path generator (4)
- b) Explain the overlay method for synthesis. (6)

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