QP Code:ME2T04-1 **(Pages:3)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

Fourth Semester B.Tech. Degree Examination, May, 2026

Course Code: B24ME2T04

Course Name: THEORY OF MACHINES

Max. Marks: 100 Duration:3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

Answer all questions

1. Sketch and explain the working of a Harts straight line motion mechanism.
2. Sketch a four bar mechanism and mark its instantaneous centers.
3. What is coriolis component of acceleration? How its magnitude is calculated?
4. List and briefly explain the various classifications of cams based on the constraint of the follower.
5. What are precision points in mechanism synthesis? Why are they important in path and motion generation problems?
6. What is meant by backlash in gears? How it can be reduced?
7. If the magnitude and direction of input torque in a mechanism is not given, then write down the sequence of drawing free body diagrams.
8. How do you take into account the friction at sliding pairs for force analysis? Give example.
9. What is the difference between static balancing and dynamic balancing?
10. What do you mean by primary and secondary unbalance in reciprocating engines?

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any One full question from each module.

Module 1

11. (a) Classify kinematic pair with examples. (10 marks)

    (b) Draw a slider crank mechanism, identify and name the links of this mechanism. (4 marks)

OR

12. (a) Explain the terms (i) Coupler curves, (ii) Mechanical advantage, (iii) Transmission angle. (6 marks)

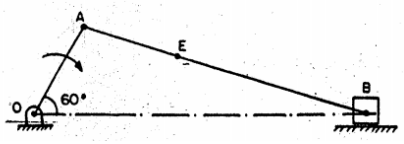
(b) Describe with suitable sketches the inversions of a double slider-crank chain. (8 marks)

Module 2

13. Derive the expressions for velocity and acceleration of a cam and follower mechanism when the follower undergoes uniform acceleration and retardation. Also, sketch the corresponding displacement, velocity, and acceleration diagrams.

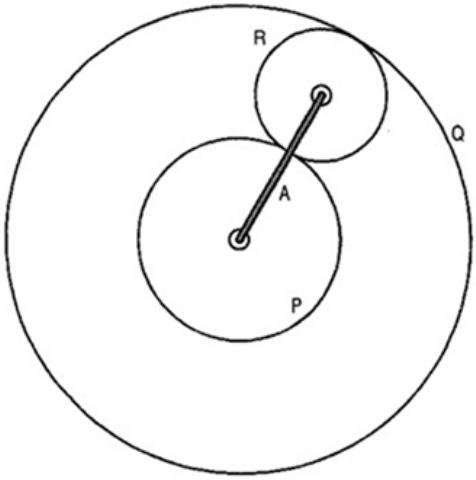
OR

14. For the configuration of a slider-crank mechanism shown in figure Determine: (i) the acceleration of the slider (ii) the acceleration of point E (iii) the angular acceleration of link AB. The crank OA rotates at 200 r.p.m. clockwise. OA=500mm; AB -1500 mm; AE = 450 mm.



Module 3

15. The figure shows an epicyclic gear train in which the wheel P having 45 teeth is geared with Q through the intermediate wheel R at the end of the arm A. When P is rotating at 63 rpm in a clockwise direction and A is rotating at 9 rpm also in clockwise direction, Q is required to rotate at 21 rpm in anticlockwise direction. Find the necessary number of teeth in Q and R.



OR

16. (a) The following data relate to a pair of 20° involute gears in mesh. Module = 6 mm, No. of teeth : pinion 17 and gear 49 ; Addenda on pinion and gear wheel = 1 module Find : (i) The number of pairs in contact (ii) The angle turned through by the pinion and the gear wheel when one pair is in contact. (10 marks)

(b) Explain (i) Cycloidal teeth profile (ii) Involute teeth profile. (4 Marks)

Module 4

17. (a) Derive the expression for gyroscopic couple using angular momentum principles. (8 marks)

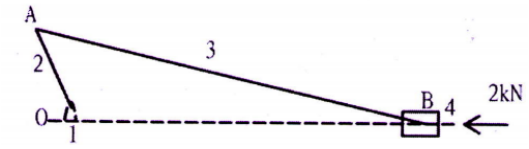
(b) Discuss the physical significance of applied gyroscopic couple in rotating systems. (6 marks)

OR

18. (a) Explain the conditions for equilibrium of a link with two force and a torque. (4 marks)

(b) A single slider crank mechanism with the following dimensions is acted upon by a force F = 2 kN at B as shown in figure. OA = 100mm, AB : 450mm, ∠AOB = 120°. Determine the input torque T on the link OA for the static equilibrium of the mechanism for the given configuration.

(10 marks)



Module 5

19. Sketch and explain the procedure for balancing of reciprocating mass.

OR

20. Draw and explain the primary and secondary force polygon and force couple of a four-cylinder four-stroke inline engine.

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