Register No.: ....   Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022
MECHANICAL ENGINEERING
(2020 SCHEME)

Course Code:	**20MET301**
Course Name:	**Mechanics of Machinery**
Max. Marks:	**100** **Duration: 3 Hours**

PART A
(Answer all questions. Each question carries 3 marks)

1. Define degrees of freedom.
2. What are straight line mechanisms?
3. State Aronhold-Kennedy's theorem.
4. How does a tangent cam work?
5. Explain circular pitch, diametrical pitch and module for gears
6. List the types of kinematic synthesis?
7. What are the conditions for static equilibrium of a two-force member?
8. How does gyroscope help in guidance of an aeroplane?
9. Differentiate between static balancing and dynamic balancing.
10. What do you mean by partial balancing in reciprocating engines?

PART B
(Answer one full question from each module, each question carries 14marks)
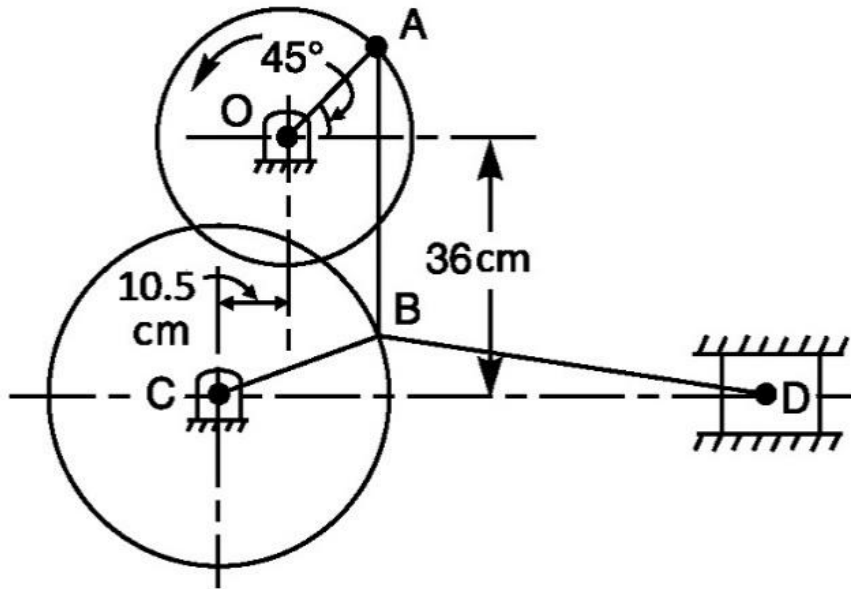
MODULE I

11. a) Define (i) mechanical advantage and (ii) transmission angle   (4)
    b) Explain any one quick return motion mechanism with a neat figure and explain the working of the same. State the category to which it belongs to.   (10)

OR

12. In the toggle mechanism, as shown in figure below, the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter-clockwise direction at a speed of 180 rpm. The dimensions of various links are as follows:

    OA = 18 cm; CB = 24 cm; AB = 36 cm; BD = 54 cm.   (14)

    For the given configuration, find:
        i.   Velocity of slider D,
       ii.   Angular velocity of links AB, CB and BD;
      iii.   Velocities of rubbing on the pins of diameter 3 cm at A and D

MODULE II

13. What do you mean by Corioli's component of acceleration? Derive the expression for Corioli's component of acceleration. What are the possible directions? (14)

OR

14. Draw the cam profile for a knife edge follower which is raised with uniform acceleration and deceleration and is lowered by simple harmonic motion (SHM). Least radius of cam = 60mm, Lift of follower = 45mm, Angle of ascent = 60⁰, Angle of dwell between ascent and descent = 40⁰, Angle of descent = 75⁰. If the cam rotates at 180 rpm, determine maximum velocity and acceleration during ascent and descent. (14)

MODULE III

15. a) Explain the working 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 gears 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. (10)

OR

16. a) Explain the overlay method of synthesis.   (4)

    b) Synthesize a four bar mechanism by using three precision points to generate y = $x^{1.5}$, where 'x' varies between 1 and 4.
Assume θ_s = 30°; $\Delta\theta$ = 90°; Φ_s = 90°; $\Delta\Phi$ = 90°
Take the length of the fixed link as 25 mm.   (10)

MODULE IV

17. Determine the torque required to be applied at the crankshaft of a slider crank mechanism to bring it in equilibrium. The slider is subjected to a horizontal force of 500N and a force of magnitude 1000N applied on the connecting rod at point C acting at an angle of 60°. The dimension of various linkages are OA=250mm, AB=750mm, AC=250mm and ∠BOA =40°   (14)

OR

18. Explain the gyroscopic effect in four wheelers. Derive the condition required for positive reaction of the same.   (14)

MODULE V

19. a) Define balancing.   (2)

    b) Explain the terms static balancing and dynamic balancing in detail with the aid of neat sketches. Also derive expressions for the same.   (12)

OR

20. A shaft carries four rotating masses A of 5 kg, B of m_B kg, C of 4.5 kg, and D of 3.5 kg in this order from left to right. The effective radii of rotation of these masses from the left are respectively 30 cm, 40 cm, 35 cm and 25 cm. The plane of rotation of A and B are 35 cm apart and that between B and C are 45 cm apart. The angle between the A and C is 120°. Determine   (14)

    (i)   The angle between A and B and that between A and D.
    (ii)   Distance between the planes of revolution of C and D,
    (iii)   The mass m_B, so that the system is in complete balance.

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