



MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : PC-ME503 Kinematics & Theory of Machines

Time Allotted : 3 Hours

Full Marks : 70

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[1 x 10 = 10]

- (i) State the law of gearing.
- (ii) Define critical speed of a shaft.
- (iii) Give examples of the bad and good effects of vibration.
- (iv) What do you mean by static balancing?
- (v) When does the governor said to be stable?
- (vi) What is the function of a flywheel in a machine?
- (vii) In which factor the direction of Coriolis component of acceleration is dependent?
- (viii) Write about the terms: free vibrations and damped vibrations.
- (ix) What are the conditions to be satisfied for interchangeability of all gears?
- (x) In which type of pair shaft with collars at both ends fitted into a circular hole?
- (xi) State Kennedy Theorem (or Three Centres-in-line Theorem).
- (xii) Classify cams based on their shape.

Group-B (Short Answer Type Question)

Answer any three of the following

[5 x 3 = 15]

2. Explain the double-slider crank mechanism in detail. Name all the inversions of double-slider crank mechanism. [5]
3. In a four bar chain ABCD, AD is fixed and is 15 cm long. The crank AB is 4 cm long and rotates at 120 r.p.m. clockwise, while the link CD (=8 cm) oscillates about D. BC and AD are equal length. Find the angular velocity of link CD when angle BAD=60°. [5]
4. Derive the expression of gyroscopic couple. [5]
5. A multi clutch has six plates (friction rings) on the driving shaft and six discs on the driven shaft. The external radius of the friction surface is 115 mm whereas the internal radius is 80 mm. Assuming uniform wear and coefficient of friction as 0.1, find the power transmitted at 2000 r.p.m. Axial intensity of pressure is not to exceed 0.16 N/mm². [5]
6. Define and explain the terms: cam profile, base circle, prime circle, pitch curve and period of dwell. [5]

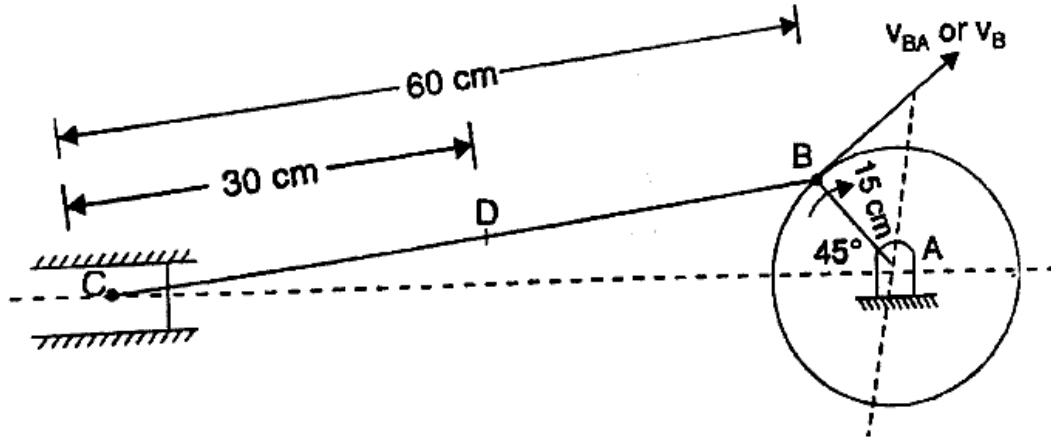
Group-C (Long Answer Type Question)

Answer any three of the following

[15 x 3 = 45]

7. What do you mean by inversion of a mechanism? Explain with sketches all the inversions of single slider crank mechanism. Where these inversions are used? [1+10+4]
8. An aircraft consist of a propeller and engine. The mass moment of inertia of propeller and engine is 100 kg.m². The engine rotates at 2500 r.p.m. in the clockwise direction if viewed from the front of the aircraft. The aircraft completes half circle of radius of 1000 m while flying at 500 km/hr. Determine the gyroscopic couple on the aircraft and state its effect. [8+7]
9. Calculate the (i) minimum speed, (ii) maximum speed and (iii) range of the speed of a Porter governor, which has equal arms each 200 mm long and pivoted on the axis of rotation. The mass of each ball is 4 kg and the central mass on the sleeve is 20 kg. The radius of rotation of the ball is 100 mm when the governor begins to lift and 130 mm when the governor is at maximum speed. [6+6+3]
10. The crank of a slider crank mechanism is 150 mm and connecting rod is 750 mm. The crank rotates at a constant speed of 300 r.p.m. clockwise. Calculate the velocity and acceleration of the slider when the crank has turned 30° from the inner dead centre position. [7+9]

11. The crank of a slider crank mechanism is 15 cm and the connecting rod is 60 cm long. The crank makes 300 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead centre position, draw the velocity diagram and determine: [7+3+2+3]
- Velocity of the slider C,
 - Angular velocity of connecting rod and
 - Linear velocity of the mid-point of the connecting rod.



*** END OF PAPER ***

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