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Question Paper Code : 60916

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Third/Fourth Semester

Mechanical Engineering

ME8492 — KINEMATICS OF MACHINERY

(Common to : Mechanical Engineering (Sandwich)/Mechatronics Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. How do you classify kinematic pairs?
2. What is meant by inversion of a mechanism?
3. Mention any two the properties of instantaneous centre?
4. Define Coriolis component of acceleration. When it occurs?
5. List the different motions of the follower.
6. What are the uses of cam profile?
7. Mention any two methods used to avoid interference?
8. What is meant compound gear train?
9. Why cross belt is used instead of open belt?
10. State the functional difference between a clutch and a brake.

PART B — ($5 \times 13 = 65$ marks)

11. (a) Explain the inversions of single slider crank chain with neat sketches.

Or

- (b) What is straight line mechanism? Sketch the peaucellier straight line motion mechanism and prove that the generating points move in a straight line.

12. (a) In a four bar chain ABCD, AD is fixed and is 200 mm long. The crank AB is 50 mm long and rotates at 150 rpm. clockwise, while the link CD = 100 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 70° .

Or

- (b) The crank of a slider crank mechanism rotates clockwise at a constant speed of 400 rpm. The crank is 200 mm and the connecting rod is 800 mm long. Determine:
- (i) Linear velocity and acceleration of the midpoint of the connecting rod, and
 - (ii) Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position.

13. (a) A cam is to give the following motion to a knife edged follower :

- (i) Outstroke during 90° of cam rotation.
- (ii) Dwell for the next 30° of cam rotation.
- (iii) Return stroke during next 90° of cam rotation and
- (iv) Dwell for the remaining of cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.

Or

- (b) In a system tangent cam operating a roller follower. The radius of the cam is 30 mm and roller radius is 15 mm. the angle of ascent is 75° and the total lift is 15 mm. The speed of the cam is 500 rpm. assume that there is no dwell between ascent and decent.

- (i) Calculate the principal dimension of the cam
- (ii) Find the acceleration of follower at the beginning of the lift
- (iii) Draw the profile of the cam.

14. (a) A pinion having 40 teeth drives a gear having 80 teeth. The profile of the gear is involute with 20° pressure angle 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.

Or

- (b) The sun planet gear of an epicyclic gear train, the annular D has 100 internal teeth, the sun gear A has 50 external teeth and planet gear B has 25 external teeth. The gear B meshes with gear D and gear A. The gear B is carried on arm E, which rotates about the centre of annular gear D. If the gear D is fixed and arm rotates at 25 rpm, then find the speeds of gear A and B.

15. (a) The mean diameter of the screw jack having pitch of 10 mm is 50 mm. A load of 25 kN is lifted through a distance of 200 mm. Find the work done in lifting the load and efficiency of the screw jack when
- The load rotates with the screw, and
 - The load rests on the loose head which does not rotate with screw. The external and internal diameter of the bearing surface of the loose head is 70 mm and 20 mm respectively. The coefficient of friction for the screw as well as the bearing surface may be taken as 0.08.

Or

- (b) Two shaft whose centers are 1 m apart are connected by a V belt drive. The driving pulley is supplied with 150 kW and has an effective diameter of 450 mm. It runs at 400 rpm. The angle of groove on the pulley is 40° . The permissible tension in 400 mm^2 cross sectional area of the belt is 2.1 MPa. The density of the belt is 1200 kg/mm^3 coefficient of friction is 0.28. Estimate number of belts required.

PART C — ($1 \times 15 = 15$ marks)

16. (a) The slider C of the toggle mechanism shown in Fig.1 is constrained to move on a horizontal path. The crank O_1A rotates in the counter clockwise direction at a uniform speed of 180 rpm. $O_1A = 200 \text{ mm}$, $AB = 400 \text{ mm}$, $O_2B = 300 \text{ mm}$, and $BC = 600 \text{ mm}$. Determine
- Velocity of slider C,
 - Angular velocity of links AB, O_2B , and BC,
 - Rubbing velocities on the pins of 25 mm diameter at A and C, and
 - Torque required at the crank O_1A for a force of 2 kN at C.

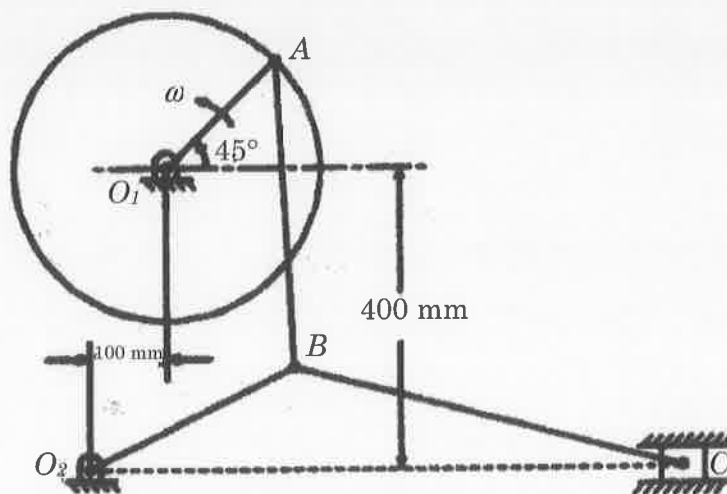


Fig. 1

Or

- (b) A band and block brake, with 15 blocks, each of which subtends an angle of 15° , is applied to a drum of 1 m diameter, as shown in Fig.2. The drum and the flywheel mounted on the same shaft has a mass of 1500 kg and a combined radius of gyration of 500 mm. Find

- Maximum braking torque,
- Angular retardation of the drum, and
- Time taken by the system to come to rest from the rated speed of 380 rpm. The coefficient of friction between the drum and the blocks can be taken as 0.25.

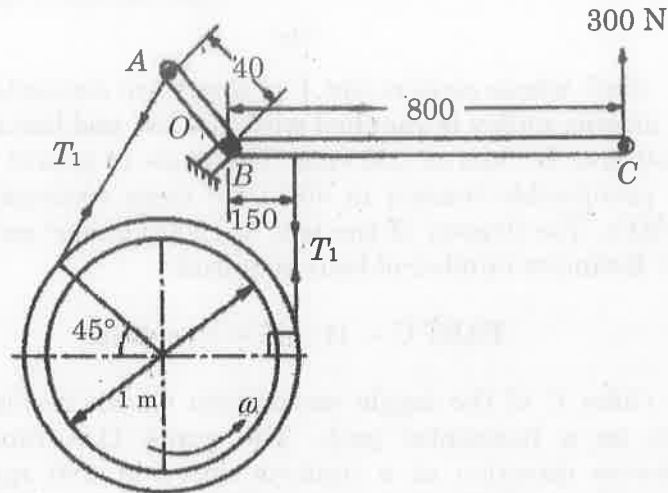


Fig.2