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Question Paper Code : 23580

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fourth Semester

Mechanical Engineering

ME 1252/070120014 — KINEMATICS OF MACHINERY

(Common to Third Semester, Mechatronics Engineering)

(Regulation 2004/2007)

(Common to B.E. (Part-Time) Third Semester, Mechanical Engineering,
Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the term Degree of freedom.
2. What are the three conditions to obtain a four bar drag-link mechanism?
3. Define instantaneous center of rotation.
4. How will you determine the magnitude and the direction of Coriolis Acceleration?
5. State the advantages of cam mechanisms over linkage mechanisms.
6. Define undercutting in a cam mechanism.
7. State the good aspects of involute tooth profile over cycloidal tooth profile.
8. State the relationship between circular pitch and the module.
9. State the laws of dry friction.
10. In an open belt drive the diameter of the smaller pulley is 250 mm. the diameter of the bigger pulley is 400 mm, and the centre distance is 2.0 m. Find the angle of lap for the smaller pulley.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the inversions of slider crank chain. (8)
- (ii) Explain the working of Pantograph with a neat sketch. (4)
- (iii) Define the significance of transmission angle of a four bar mechanism. (4)

Or

- (b) (i) Sketch two general exception mechanisms for Kutzbach criterion, with suitable proof. (4)
- (ii) How to represent the direction of linear velocity of any point on a link with respect to another point on the same link? (4)
- (iii) With the help of a neat sketch explain the working of Whitworth quick return mechanism. (8)
12. (a) The Crank of a slider crank mechanisms rotates clockwise at a Constant speed of 600 rpm. The crank is 125 mm and connecting rod is 500 mm long. Determine
- (i) Linear velocity and acceleration of the mid Point 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. (16)

Or

- (b) PQRS is a four bar chain with link PS fixed (Fig.Q 12(b)). The length of the links are $PQ=62.5$ mm; $QR=175$ mm; $RS=112.5$ mm; and $PS=200$ mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle $QPS=60^\circ$ and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of the links QR and RS. (16)

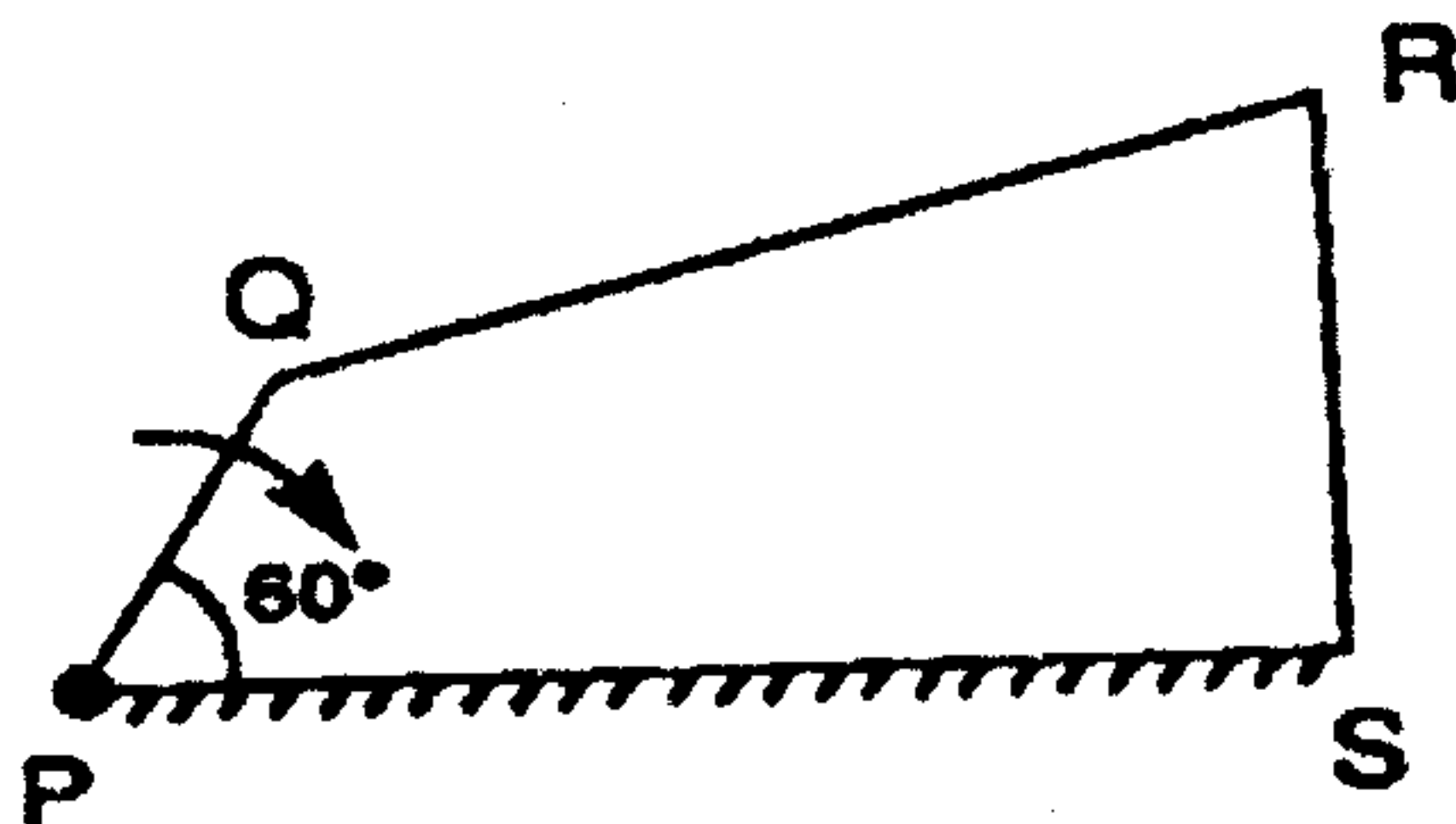


Fig Q 12(b)

13. (a) Draw the profile of a cam in which the follower moves with simple harmonic motion during rise while it moves with uniform acceleration and retardation motion during return, from the following data:

Least radius of cam	= 50mm
Roller diameter	= 30mm
Angle of rise	= 88°
Angle of return	= 80°
Offset of the follower	= 20mm right
Lift of the follower	= 40mm
Angle of dwell between rise and return	= 72°

If the cam rotates at 360 rpm clockwise find the maximum velocity during return. (16)

Or

- (b) A tangent cam with a base circle diameter of 50mm operates a roller follower 20 mm in diameter. The line of stroke of the roller follower passes through the axis of the cam. The angle between the tangential faces of the cam is 60°, speed of the cam shaft 200 rpm and the lift of the follower 15mm. Calculate:

- (i) The main dimensions of the cam (6)
- (ii) The accelerations of the follower at (10)
 - (1) The beginning of lift
 - (2) Where the roller just touches the nose
 - (3) The apex of the circular nose.

14. (a) Two gear wheels mesh externally to give a velocity ratio of 3 to 1. The involute tooth has 6 mm module and 20° pressure angle. Addendum is equal to one module. The pinion rotates at 90 rpm. Determine :

- (i) Number of teeth on pinion to avoid interference and the corresponding number on the wheel
- (ii) The length of path and arc of contact
- (iii) Contact ratio and
- (iv) The maximum velocity of sliding. (16)

Or

- (b) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. if the gear A instead of being fixed makes 300 rpm in the clockwise direction, what will be the speed of gear B? Find by Tabular and Algebraic methods. (16)
15. (a) The mean diameter of the screw jack having pitch of 10mm is 50mm. A load of 20 KN is lifted through a distance of 170 mm. Find the work done in lifting the load and efficiency of the screw jack when (i) the load rotates with the screw, and (ii) 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 60mm and 10mm respectively. The coefficient of friction for the screw as well as the bearing surface may be taken as 0.08. (16)

Or

- (b) Two shafts whose centers are 1 m apart are connected by a V belt drive. The driving pulley is supplied with 100 KW and has an effective diameter of 300 mm. It runs at 375 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 1100 kg/mm^3 and Coefficient of friction is 0.28. Estimate number of belts required. (16)