



P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fourth Semester, B.E. - Automobile Engineering

Semester End Examination; June/July - 2015

Theory of Machines - I

Time: 3 hrs

Max. Marks: 100

- Note:** i) Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.
ii) Assume suitable missing data if any.

UNIT - I

1. a. With the help of suitable example and sketch, explain classification of kinematic pairs. 10
- b. Explain any two inversions of four bar chain. 10
- 2 a. Explain with a neat sketch, Whitworth quick return motion mechanism. 8
- b. State and prove the principle adopted in exact straight line motion mechanism. 6
- c. Explain with neat sketch, toggle mechanism. 6

UNIT - II

3. The crank and connecting rod of a steam engine are 0.5 m and 2 m long respectively. The crank makes 180 rpm in the clock wise direction. When it has turned 45° from the inner dead centre position determine velocity of piston and angular velocity of connecting rod. 20
Do the above problem through both relative velocity method and I.C. method.
4. A mechanism as shown in Fig. (4) has the following dimensions : OA = 200 mm; AB = 1500 mm, BC = 600 mm CD = 500 mm and BE = 400 mm. Locate all the instantaneous centers. 20
If the crank OA rotates uniformly at 120 rpm. Clockwise, find
(a) the velocity of B, C and D.
(b) The angular velocity of the links AB, BC and CD

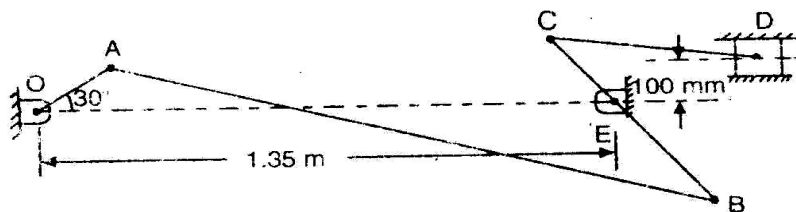


Fig. (4)

UNIT - III

5. PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm; QR = 175 mm, RS = 112.5mm, and PS = 200 mm. the crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angles QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of the links QR and RS. 20

- 6 a. Explain Coriolis component of acceleration. 6
- b. The crank and connecting rod of a reciprocating engine are 200 mm and 700 mm respectively. The crank is rotating in clockwise direction at 120 rad/s. Find with the help of Klein construction;
- i) Velocity and acceleration of the piston 14
- ii) Velocity and acceleration of the midpoint of the connecting rod
- iii) Angular Velocity and angular acceleration of the connecting rod, at the instant when the crank is at 30° to inner dead center.

UNIT – IV

- 7 a. Derive an expression to the length of path of contact in a pair of involutes teeth. 10
- b. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle. 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and contact ratio. 10
- 8 a. Explain Reverted gear train. 4
- b. Fig. (8) shows a compound epicyclic gear train. Wheel A, D and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P, on the end of arm OP. All the teeth on different wheels have same module. A has 12 teeth, B has 30 teeth and C has 14 teeth cut externally. Find the number of teeth on wheels D and E which are cut internally.
- If the wheel A is driven clockwise at 1 r.p.s. determine the magnitude and direction of the angular velocities of arm OP and wheel E. 16

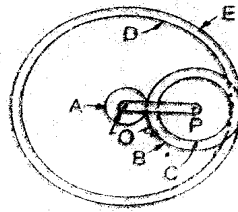


Fig (8)

UNIT – V

9. Draw a cam profile to drive an oscillating roller follower to the specification given below: 20
- (i) Follower to move outwards through an angular displacement of 20° during the first 120° .
- (ii) Follower to return to its initial position during next 120° rotation of the cam.
- (iii) Follower to dwell during the next 120° of cam rotation.
- The distance between pivot center and roller centre = 120mm. Distance between pivot centre and cam axis = 130 mm. Minimum radius of cam = 40 mm; radius of roller = 10 mm; Inward and outward strokes takes place with simple Harmonic motion and UARM respectively.

- 10 a. Derive an expression for displacement, velocity and acceleration for a Tangent cam with reciprocating roller follower when the contact is with straight flank. 10
- b. A symmetrical circular cam operating a flat faced follower has the following particulars; minimum radius of the cam = 30 mm; total lift = 20 mm; Angle of lift = 75°, Nose radius = 5mm; speed = 600 rpm.
- Find; 10
- (i) The principal dimensions of the Cam
- (ii) The acceleration of the follower at the beginning of the lift, at the end of contact with circular flank.

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