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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 - 2016

Theory of Machines - I

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Missing data if any may be suitably assumed and stated.
iii) For Graphical solutions use drawing sheets.

UNIT - I

1 a. Explain the following with appropriate sketches : 6
i) Cylindrical pair ii) Screw pair iii) Spherical pair.

b. Define kinematic inversion and explain any one inversion of double slider crank chain. 8

c. Sketch and explain Pendulum pump mechanism. 6

2 a. With neat sketch, explain drag link quick return motion mechanism. 8

b. What is intermittent motion mechanism? Explain with neat sketch, Ratchet and Powl mechanism. 6

c. Sketch and explain Peaucellier straight line mechanism. 6

UNIT - II

3 a. Discuss the types of instantaneous with neat sketches. 5

b. The driving crank O_1A of mechanism shown in Fig. 3(b) is rotating at 200 rpm. For the given configuration, locate all the instantaneous centres and determine angular velocity of link BC. Given O_1A = 50 mm, AB = 100 mm, AD = 200 mm, O_1O_2 = 100 mm and BC = O_2C = 100 mm. 15

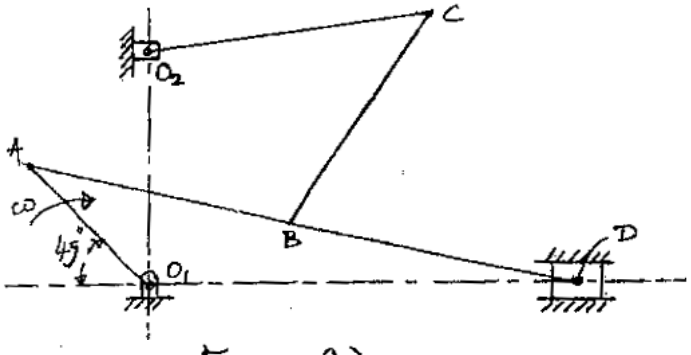

Fig. 3(b)

4 a. Determine the linear velocity of slider E and angular velocity of link BC for the mechanism shown in Fig. 4(a). The link AB rotates at uniform speed of 60 rpm. Given AB = 30 mm, BC = 45 mm, CD = 40 mm, AD = 60 mm and CE = 40 mm. 10

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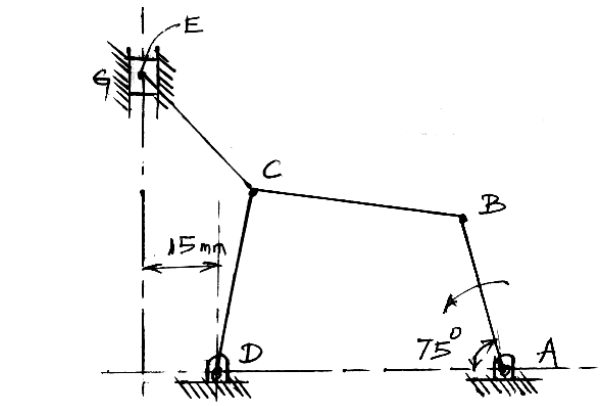

Fig. 4(a)

b. In a crank and slotted lever quick return motion mechanism shown in Fig. 4(b), the lengths of links are OA = 300 mm, AB = 200 mm, OD = 600 mm and DE = 500 mm. The crank OA rotates at 90 rpm in clockwise direction. Determine angular velocity of OD and velocity of ram E. 10

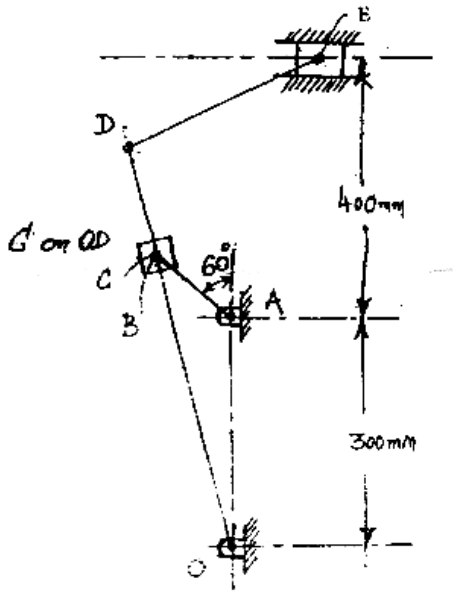

Fig. 4(b)

UNIT - III

5. Determine the angular velocity of link AB, BC and BD. Also find the angular acceleration of links BC and BD and linear acceleration of slider 'D' for the given mechanism shown in Fig. 5. The crank rotates at 200 rpm. 20

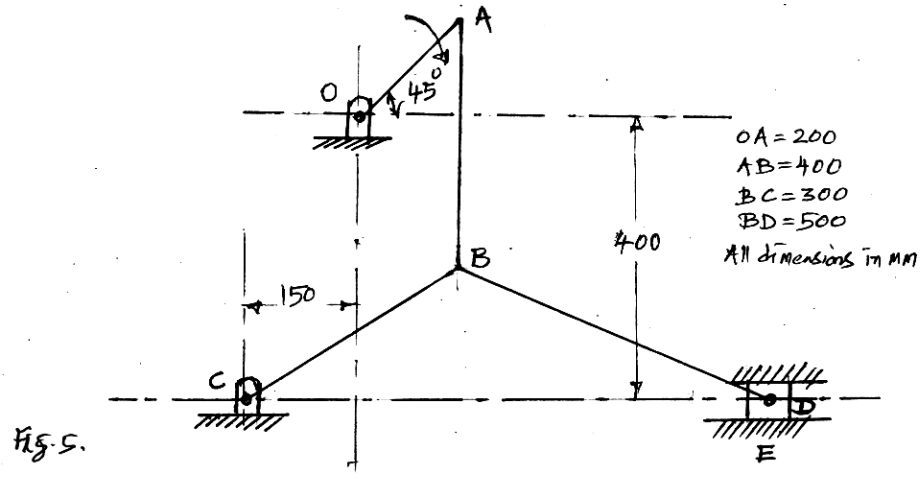

Fig. 5.

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6. Determine the ;

(i) Velocity of ram E (ii) Magnitude of coriolis acceleration

iii) Acceleration of ram E, for the crank and slotted quick return motion mechanism shown in Fig. 6. Given OA = 200 mm, CD = 700 mm, BC = 500 mm and OC = 400 mm. The crank OA rotates at 150 rpm. 20

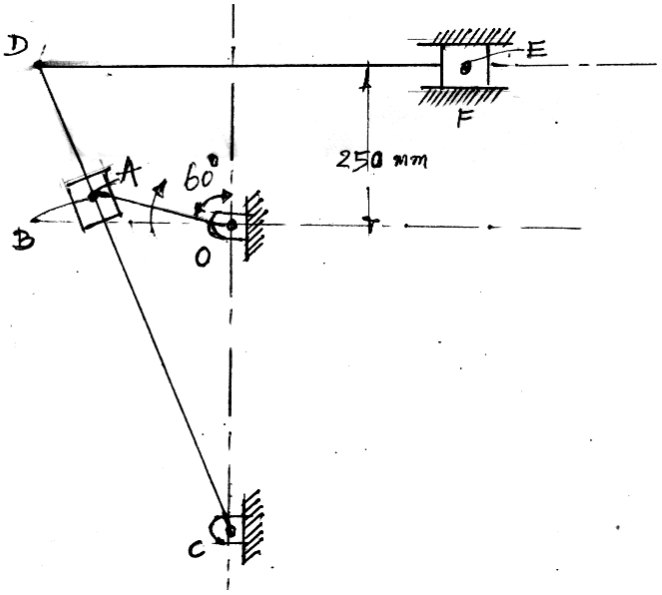

Fig. 6

UNIT - IV

7 a. Derive an expression to determine minimum number of teeth on pinion inorder to avoid interference. 8

b. A pinion having 30 teeth drives a spur gear having 80 teeth. The profile of the gear is involute with 20º pressure angle, 12 mm module and addendum 10 mm. Determine; 12

i) Length of path of contact ii) Arc of contact iii) Contact ratio.

8 a. With neat sketch explain how the speed of crown wheel in differential unit is determined. 6

b. In an epicyclic gear train shown in Fig. 8, the driving wheel 'A' has 12 teeth and the fixed annudar wheel 'C' has 98 teeth, The ratio of teeth numbers in wheels E and D is 90: 36. If 1.8 kW of power at 1100 rpm is supplied to wheel 'A', determine speed and the direction of rotation of E and fixing torque required at C. 14

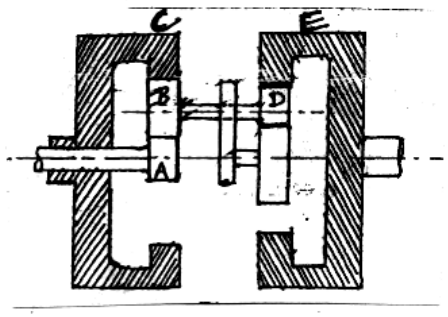

Fig. 8

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UNIT - V

9. A cam rotates at uniform speed of 200 rpm and it gives oscillatory follower of 70 mm long an angular displacement of 40º in each stroke. The follower is fitted with a roller 20 mm diameter which makes the contact with cam.

   The outward and return stroke of the follower, each occupy 120ºof cam rotation and there is no dwell in the lifted position. If the follower moves with simple harmonic motion for both strokes, draw a profile of cam. The axis of the fulcrum of follower is 90 mm from axis of cam. The least distance of the roller axis and axis of the cam shaft is 50 mm. 20

10 a. Derive an expression for displacement, velocity and acceleration of the follower when the roller has contact on straight flank of tangent cam. 8

   b. A symmetrical circular arc cam operating a flat faced follower has the following particulars. Last radius = 16 mm; Nose radius = 3.2 mm; Distance between cam shaft centre and nose centre = 25 mm and cam speed = 600 rpm. Determine the lift of the follower, flank radius, acceleration and retardation of follower at a point where circular nose merges with circular flank. 12

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