



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

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Automobile Engineering

Semester End Examination; May / June - 2018

Theory of Machines - I

Time: 3 hrs

Max. Marks: 100

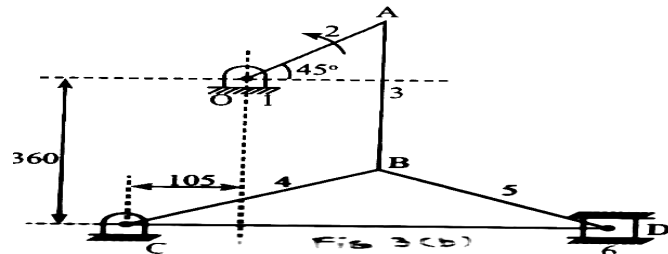
Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

UNIT - I

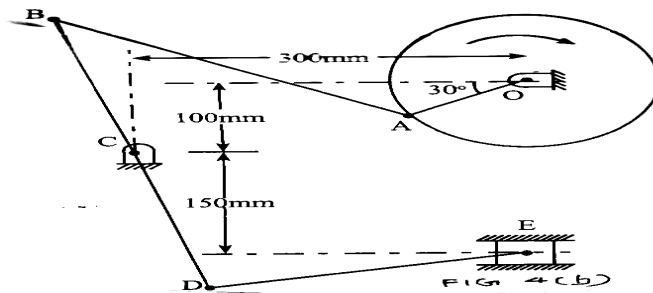
- 1 a. Differentiate between;
 - (i) Structure and Machine
 - (ii) Machine and Mechanism
- b. With the help of examples, explain the classification of kinematic pair.
- c. Sketch and explain elliptical Trammel.
- 2 a. Sketch and explain crank and slotted lever quick return motion mechanism.
- b. Prove that Peaucelliers mechanism can be used to draw exact straight line motion.

UNIT - II

- 3 a. Explain different types of instantaneous centres.
- b. In the toggle mechanism shown in Fig. Q.3(b) crank OA is rotating in CCW direction at speed of 1800 rpm. The dimensions of various links are: OA = 180 mm, CB = 240 mm, AB = 360 mm, BD = 640 mm. Find through IC method;
 - (i) Velocity of slides
 - (ii) Angular velocity of the link AB, CB

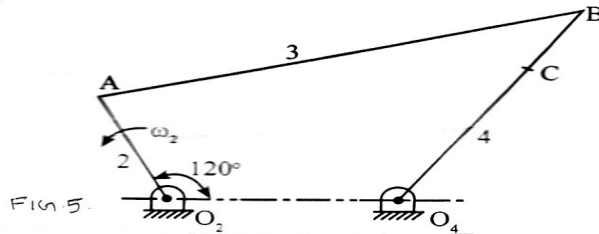


- 4 a. State and prove Kennedy's theorem.
- b. In a mechanism shown in Fig. Q.4(b) crank OA rotates at a speed of 100 rpm in clockwise direction. The dimensions of various links are OA = 100 mm, BC = CD = 200 mm, AB = 300 mm, DE = 250 mm. Find velocity of slides E. Through relative velocity method.



UNIT - III

- 5. A four bar mechanism is shown in Fig. Q.5, determine the acceleration of C and angular acceleration of link AB, when crank OA rotates at 20 rad/s. $O_2O_4 = 200$ mm, $O_2A = 150$ mm, $AB = 450$ mm, $O_4B = 300$ mm, $O_4C = 200$ mm.



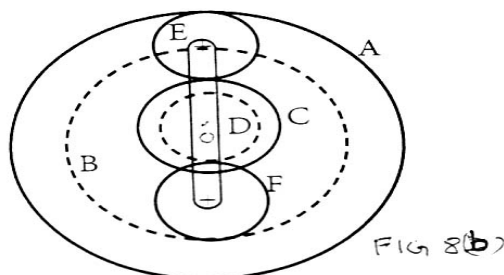
- 6 a. What is coriolis component? Derive the expression for the same. 6
- b. The lengths of the crank and the connecting rod of a reciprocating engine are 100 mm and 500 mm respectively. The crank is rotating at 400 rpm using Klein's construction, find;
- (i) Velocity of piston 14
 - (ii) Angular velocity of the connecting rod
 - (iii) Acceleration of piston
 - (iv) Angular acceleration of connecting rod when the crank has turned 30° from the inner dead centre

UNIT - IV

- 7 a. Derive an expression for 'arc of contact'. 8
- b. A pair of spur gears with involute teeth is given a gear of 4:1. The arc of approach is not to be less than the circular pitch and the smaller wheel teeth drive. The angle of pressure 14 ½". 12
- (i) What is the best number of teeth that can be used on each wheel?
 - (ii) What is the addendum of the wheel in terms of the circular pitch?
- 8 a. Explain different types of gear trains. 6
- b. An epicyclic gear train shown in Fig. Q.8(b), the compound wheel CAD rotates about the axis O. The number of teeth on E and F are 18, C = 28, D = 28. 14
- (i) Find the number of teeth on A and B
 - (ii) If the arm G makes 150rpm CW and A is fixed, find speed of B

UNIT - V

9. The following data relate to cam profile in which roller moves with SHM during ascent and UARM during descent. Minimum radius of the cam = 30 mm, roller radius = 8 mm, lift = 28 mm, offset of the follower axis = 12 mm towards right, angle of ascent = 90°, angle of descent = 60°, angle of dwell between ascent and descent = 45°. Speed of the cam = 200 rpm in CCW direction. Draw the profile of the cam and determine max velocity and acceleration during outstroke and return stroke. 20
- 10 a. Derive expression for displacement, velocity and acceleration for a flat faced follower when it is contact on the circular flank of a circular arc cam. 10
- b. A circular arc cam operating a flat force follower has the following particulars. Least radius of cam = 30 mm, lift = 20 mm, angle of lift = 75°, nose radius of cam = 30 mm, lift = 20 mm, angle of lift = 75°, Nose radius = 5mm, speed = 600 rpm. Find;
- (i) The principal dimensions of cam
 - (ii) The acceleration of follower at the beginning of lift, at the end of contact with circular flank.



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