



**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

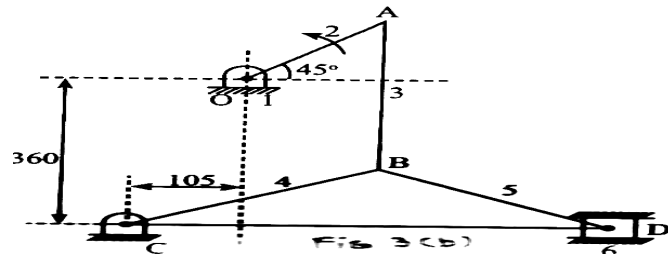
Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.

**UNIT - I**

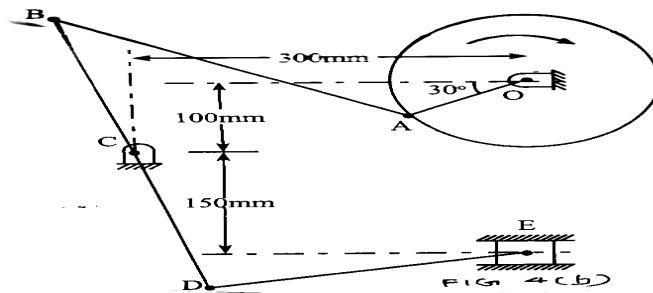
- 1 a. Differentiate between;
  - (i) Structure and Machine                      (ii) Machine and Mechanism 6
- b. With the help of examples, explain the classification of kinematic pair. 8
- c. Sketch and explain elliptical Trammel. 6
- 2 a. Sketch and explain crank and slotted lever quick return motion mechanism. 10
- b. Prove that Peaucelliers mechanism can be used to draw exact straight line motion. 10

**UNIT - II**

- 3 a. Explain different types of instantaneous centres. 6
- 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

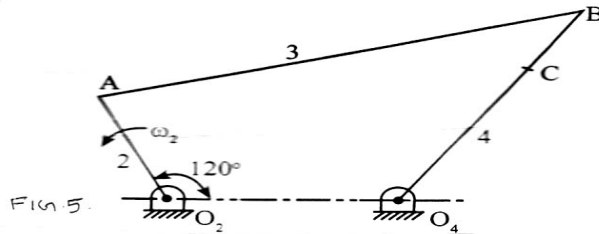


- 4 a. State and prove Kennedy's theorem. 6
- b. In a mechanism shown in Fig. Q.4(b) crank OA rotates at a speed of 100 rpm in clockwise direction. The dimensions of various links are OA = 100 mm, BC = CD = 200 mm, AB = 300 mm, DE = 250 mm. Find velocity of slides E. Through relative velocity method.



**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. 20



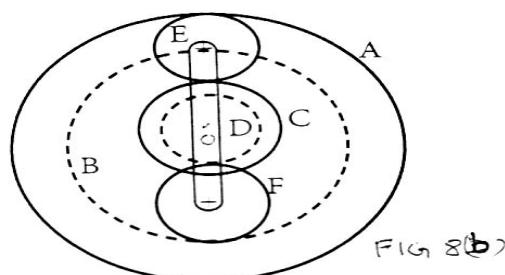
- 6 a. What is coriolis component? Derive the expression for the same. 6
- b. The lengths of the crank and the connecting rod of a reciprocating engine are 100 mm and 500 mm respectively. The crank is rotating at 400 rpm using Klein's construction, find;
- (i) Velocity of piston 14
  - (ii) Angular velocity 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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