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Fourth Semester B.E. Degree Examination, Dec.2013/Jan.2014

Kinematics of Machines

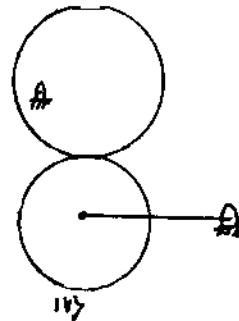
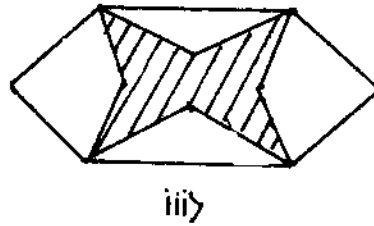
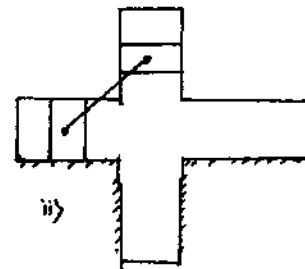
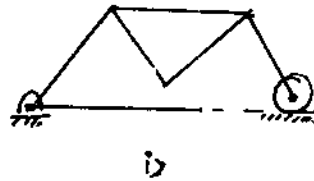
Time: 3 hrs.

Max. Marks:100

Note:1. Answer FIVE full questions, selecting at least TWO questions from each part.
2. Graphical solution may be obtained either on graph or on answer sheet.

PART – A

- 1 a. Define degrees of freedom. Find the degrees of freedom for the following mechanism as shown in Fig.Q1 (a) (10 Marks)



- b. Define the following terms with examples:
 i) Kinematic pair ii) Mechanism iii) Structure iv) Inversion (10 Marks)
- 2 a. Describe with neat sketch two inversion of double slider-crank chain mechanism. (10 Marks)
 b. Derive an expression for necessary condition of correct steering and explain Ackermann steering gear with neat sketch. (10 Marks)

- 3 A four bar mechanism shown in Fig. Q3 crank BC rotates with an angular velocity of 100 rad/sec and an angular acceleration of 4400 rad/sec² at the instant when the crank makes an angle 53° to the horizontal. Draw the acceleration polygon and determine the linear acceleration of points E and the angular acceleration of link 3. (20 Marks)

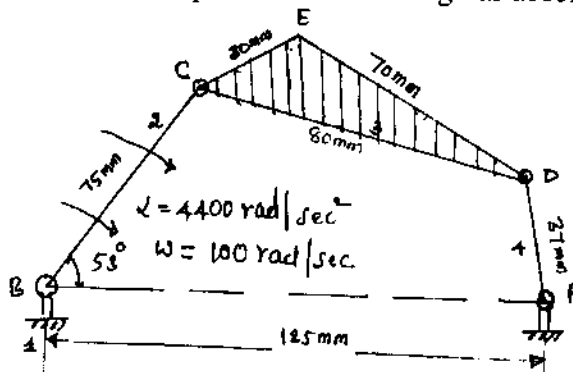


Fig. Q3

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 4 a. Write a note on Kennedy's theorem. (05 Marks)
 b. List the properties of instantaneous centre of rotation. (05 Marks)
 c. In a slider crank mechanism shown in Fig. Q4 (c) the crank OA = 300 mm and connecting rod AB = 1200 mm the crank OA is turned 30° from inner dead centre. Locate all the instantaneous centres. If the crank rotates at 15 rad/sec clockwise, find i) velocity of slider B and ii) Angular velocity of connecting rod AB. (10 Marks)

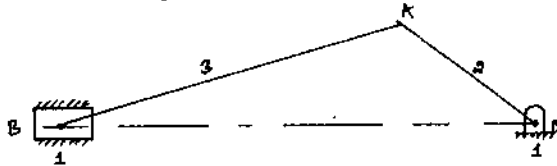


Fig. Q4 (c)

PART - B

- 5 a. Derive an expression for displacement analysis of a 4 bar mechanism using complex algebra method. (10 Marks)
 b. For a single slider mechanism, of Fig. Q5 (b) determine the velocity and acceleration of piston, angular acceleration of connecting rod. Take crank length = 50 mm, connecting rod = 200 mm, Crank speed = 300 rpm (constant), Crank angle 30°. (10 Marks)

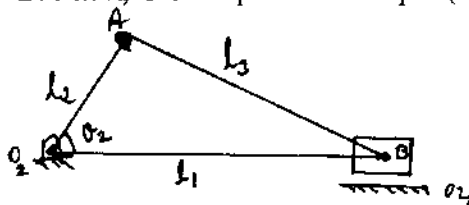


Fig. Q5 (b)

- 6 a. Derive an equation to determine length of arc of contact for mating of 2 spur gear. (08 Marks)
 b. Two gear wheel mesh externally and are to give a velocity ratio of 3. The teeth are of involute form of module 6 mm and standard addendum one module. Pressure angle = 18°. Pinion rotates at 90 rpm. Find
 i) Number of teeth on each wheel so that interference is just avoided.
 ii) Length of path of contact.
 iii) Maximum velocity of sliding between teeth.
 iv) Number of pairs of teeth in contact. (12 Marks)
- 7 a. Explain with neat sketch classification of gear trains. (06 Marks)
 b. In an epicyclic gear train, the internal wheels A, B and the compound wheel C and D rotate independently about the axis 'O'. The wheel E and F rotate on a pin fixed to the arm G. E gear with A and C, and F gears with B and D. All the wheels have same pitch and the number of teeth on E and F are 18, C and D are 28, 26 respectively.
 i) Sketch the arrangement.
 ii) Number of teeth on A and B.
 iii) If arm (G) makes 200 rpm clockwise and gear A is fixed, find speed of gear B
 iv) If arm (G) makes 100 rpm clockwise and gear A make 50 rpm CCW, find the speed of gear B. (14 Marks)
- 8 A cam rotating at uniform speed of 300 rpm operates a reciprocating follower through a roller 1.5 cm diameter. The follower motion is defined as below:
 i) Outward during 150° with UARM.
 ii) Dwell for next 30°
 iii) Return during next 120° with SHM.
 iv) Remaining dwell period.
 Stroke of the follower is 3 cm. Minimum radius of cam is 3 cm. Draw the cam profile when the follower axis is offset to the left by 1 cm and determine maximum velocity and maximum acceleration during outstroke. (20 Marks)
