10ME/AU44

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Kinematics of Machines

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1   a. Define the following, giving one example for each:
        i) Kinematic chain   ii) Mechanism   iii) Structure
        iv) Inversions   v) Degree of freedom   **(10 Marks)**
    b. Explain with a neat sketch, the double slider crank chain mechanism and its inversions (any two inversions with application).   **(10 Marks)**

2   a. Explain with a neat sketch crank and slotted lever quick return motion mechanism. **(08 Marks)**
    b. Sketch Peaucellier's mechanism, and prove that it can trace a straight line.   **(06 Marks)**
    c. With a neat sketch, explain the condition for correct steering for Ackermann's mechanism.
                                                                                           (06 Marks)

3   a. For the mechanism shown in Fig.Q3(a), the crank OA rotates at 20 rpm in CCW and gives motion to the blocks 'B' and 'D'. The dimensions of various links are OA = 300 mm, AB = 1200 mm, BC = 450 mm and CD = 450 mm. For the given configuration, determine:
        i) velocity of the sliding block B and D.
        ii) Angular velocity of CD
        iii) Linear acceleration of 'D'

Fig.Q3(a)   **(15 Marks)**

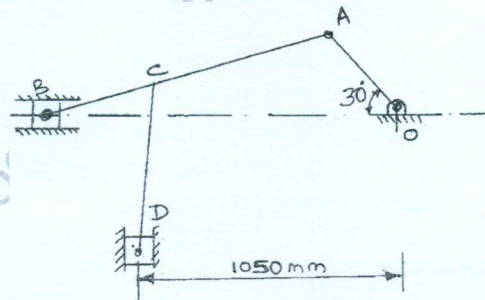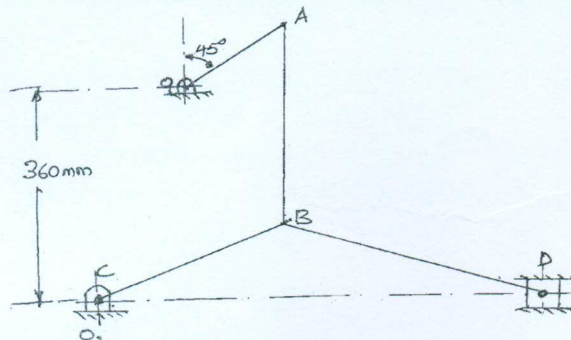   b. What is Corolis component of acceleration? Explain with an example and neat sketch.
                                                                                           (05 Marks)

4   a. State and prove Kennedy's theorem.   **(05 Marks)**
    b. Explain the analysis of velocity and acceleration of a piston in a single slider crank mechanism using Klein's construction.   **(05 Marks)**
    c. Locate all the instantaneous centres of the mechanism shown in Fig.Q4(c).   **(10 Marks)**

$O_1A = 180$ mm
$CB = 240$ mm
$AB = 360$ mm
$BD = 540$ mm

Fig.Q4(c)

PART – B

5 For an offset slider crank mechanism shown in Fig.Q5, write the loop close equation and determine the expression for,
i)   Connecting rod angle and output displacement
ii) Angular velocity of connecting rod
iii) Angular acceleration of connecting rod
iv) Angular acceleration of piston.
(Use complex number method).
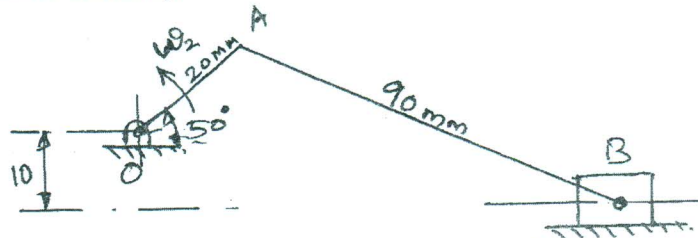

Fig.Q5
OA rotates with uniform angular velocity of 15 r/s.
OA = 20 mm   AB = 90 mm   **(20 Marks)**

6 a. Derive an expression to determine length of arc of contact for a pair of mating gears.
(10 Marks)

   b. A pair of gears having 40 and 30 teeth respectively are of 25 degree involute form. Addendum = 5 mm, module = 2.5 mm. If the smaller wheel is the driver and rotate at 1500 rpm, find the velocity of sliding at the point of engagement, at pitch point and at the point of disengagement, length of patch of contact and length of arc of contact.   **(10 Marks)**

7 a. Explain with neat sketch, the classification of gear trains.   **(06 Marks)**

   b. The Fig.Q7(b) shows an epicyclic gear train where the arm 'A', the driver and annular gear 'D' is the follower. The wheel 'D' has 112 teeth and B has 48 teeth, 'B' runs freely on pin 'P' and 'D' is separately driven. The arm 'A' runs at 100 rpm and wheel 'D' at 50 rpm in same direction. Find the speed of wheel 'B' and 'C'.
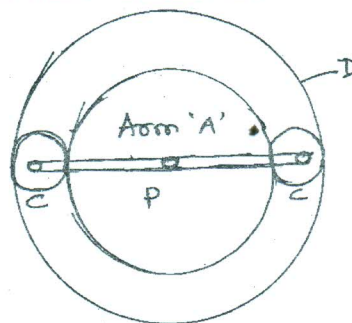

Fig.Q7(b)   **(14 Marks)**

8 The following data relate to a cam profile in which, the roller follower moves with uniform acceleration and retardation motion during ascent and descent. Minimum radius of cam = 25 mm. Roller radius = 8 mm. Lift = 32 mm, offset of follower axis = 12 mm towards right, angle of ascent = 60°, angle of descent = 90°, angle of dwell between ascent and descent = 45°, speed of cam = 20 rpm clockwise. Draw the profile of cam.   **(20 Marks)**

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