Minor I Examination on 27th August 2016

Kinematics and Dynamics of Machines (MCL111)

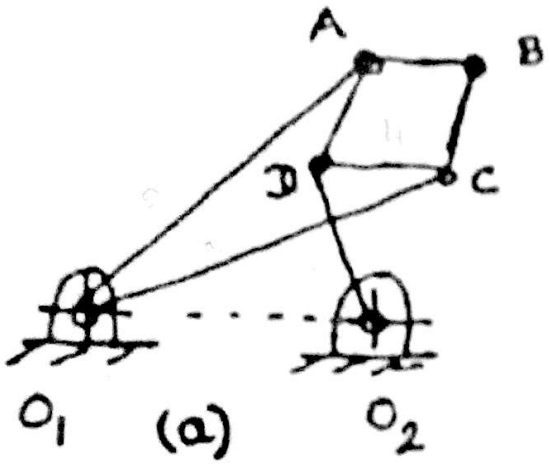
Use figure 1 for construction of velocity polygon and attach with your answer book

Time: 1 hour Full Marks: 40

Problem 1

a) Find the out the degrees of freedom of the Peaucellier mechanism, used to generate straight line motion of the point B perpendicular to O_1O_2, and shown schematically in figure (a). In the diagram shown, link O1D is the driver.

(5)



For the Peaucellian mechanism in (a)

O_1A O_1C, $AB=BC$ CD DA O_1D O_2O

b) Show that for a Grashoffian 4R-1 bar double rocker, neither rocker shall cross the fixed base line

(5)

Problem 2

a) Draw the kinematic diagram of a slider-crank mechanism and show that an oscillating cylinder mechanism is obtained as an inversion. Indicate the link of the slider crank mechanism, that requires fixing for the inversion. (5)

b) Draw the equivalent mechanism with lower pairs for the one shown at any instant in figure 2(b). Is the equivalent mechanism valid for all the instants? Specify the important dimension. The necessary dimensions (distances and the angles) may be collected from the figure. (4+1)

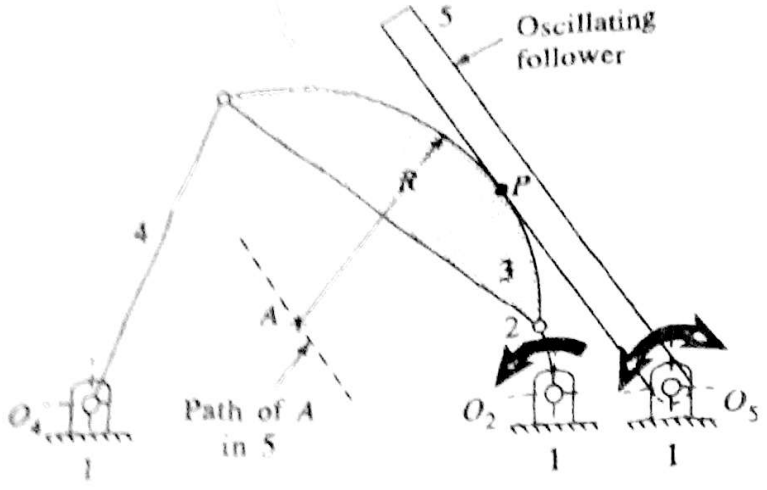


Figure 2(b)

Problem 3

a) A 4 bar mechanism is used as an oscillating lawn sprinkler as shown in figure 3. AB = 12 mm, BC = 22 mm, CD = 42 mm, DA = 16 mm. The sprinkler pipe is rigidly connected to the follower BC by a plate makes an angle of 105° with BC. Find the angles about the vertical within which the sprinkler will function. (5)

b) Is the throw of the sprinkler same on the right and left of the vertical? (1)
If not, design the link lengths, for the coupler CD and follower BC so that the throw of the sprinkler (or the angles of tilt of the sprinkler) on both sides of the vertical is 30° each and there is no quick return effect. (4)

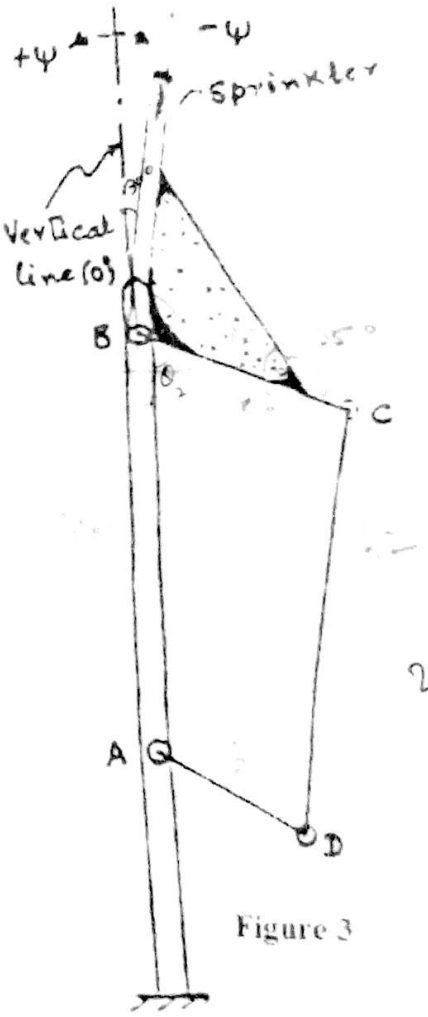


Figure 3

Problem 4

Figure 4 on the adjoining sheet gives the kinematic diagram of a mechanism. The points C and O_5 are connected by a prismatic pair, where the cylinder is able to oscillate about O_5. Dimension of different links may be collected from the diagram. Given that angle (AO_4O_2) = Angle (O_2AO_4) = Angle (DO_2O) = 90° and angle $(C\ O_2O)$ = 60°. The kinematic diagram may be used for the position of different links at the instant of time.

a) Find the degrees of freedom of the mechanism. (2)

b) For the instant shown the link O_2D is given a clockwise rotation of 1 radian/sec, and the point C expands at the rate of 0.1 m/s outwards, i.e. C moves away from O_5. Draw the velocity polygon for the instant shown. (4)
Find the angular velocity (magnitude and sense) of the link O_5C. (1+1)
Also find the angular velocity of the link BCD (magnitude and sense) from the velocity polygon. (1+1)

P.T.O.