Code No: 114CZ

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, May - 2015
KINEMATICS OF MACHINES
(Common to ME, MCT, MSNT)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.
Illustrate your answers with NEAT sketches wherever necessary

Part- A **(25 Marks)**

1.a) Distinguish between a machine and mechanism. How do they differ? [2M]
b) Two parallel shafts are connected by an Oldham coupling. The distance between the shafts is 30 mm. The speed of the driving shaft is 500 rpm. Find the maximum speed of sliding of the tongue of the intermediate piece in the slot in the flange. [3M]
c) Define ***rubbing velocity*** in a pin joint. What will be the rubbing velocity at a pin joint when the two links move in the same direction? [2M]
d) Explain how you determine the various instantaneous centres in a four – bar chain. [3M]
e) What is the difference between copied and generated straight line motions? Give one example for each of them. [2M]
f) In a Hooke's joint, prove that if the angle between the shafts is small, the total fluctuation of velocity ratio varies as the square of the shaft angle. [3M]
g) Define and explain the terms: Cam angle, circular pitch, pressure angle, lift. [2M]
h) Draw the displacement, velocity and acceleration diagrams for a follower when it moves with uniform velocity. [3M]
i) Define the following terms related to worm and worm gears: axial pitch, lead, and lead angle. [2M]
j) Explain the term 'train value'. How is it related to velocity ratio? [3M]

Part-B **(50 Marks)**

2.a) In a four bar mechanism, the lengths of driving crank, coupler, and follower link are 150 mm, 250 mm, and 300 mm respectively. The fixed link length is L_o. Find the range of values for L_o so as to make it a:
i) crank-rocker mechanism ii) crank-crank mechanism.
b) Prove that in the elliptical trammel mechanism, any point on the link connecting the two sliders (except the mid – point) connecting the two sliders will trace an ellipse. Draw a sketch of the mechanism. [6+4]

OR

3.a) In a whitworth quick return mechanism, the distance between the fixed centres is 60 mm and the driving crank length is 80 mm. The length of the slotted lever is 160 mm and the length of connecting rod is 140 mm. Calculate the ratio of the times of cutting and return strokes. Draw a sketch of the mechanism.

b) Describe with a neat sketch the hand pump mechanism as an inversion of single slider crank chain. [6+4]

4.a) The lengths of crank and connecting rod of a vertical reciprocating engine are 150 mm and 750 mm respectively. The crank rotates at 400 rpm clockwise. Find analytically the acceleration of the piston when the crank has turned through 30^0 from the top dead center, and the piston is moving downwards.

b) A rigid link AB is rotating anti-clockwise about the point A with angular velocity ω and angular acceleration α. Describe the method of drawing the acceleration diagram and find the total acceleration of B with respect to A. [6+4]

OR

5. In a mechanism shown in figure 1, the crank AB rotates clockwise at 200 rpm. The link lengths are: AB = 12 cm; BC = 48 cm; CD = 18 cm; DE = 36 cm; EF = 12 cm; FP = 36 cm. Find the velocities of the points C, E, and P, using the ***Instantaneous center method.*** [10]

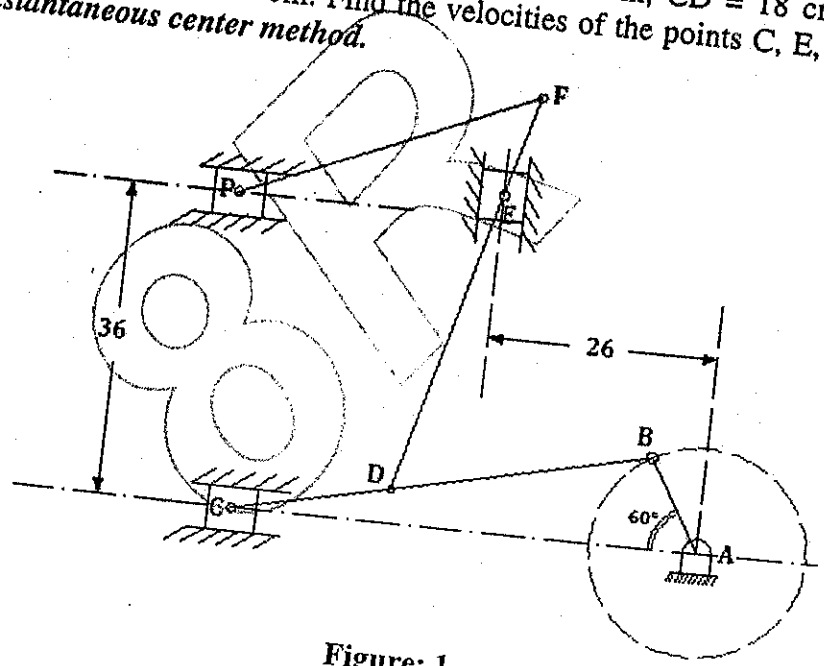

Figure: 1

(All dimensions are in cm)

6.a) Sketch and explain the working of Robert's straight line motion mechanism.

b) In a double Hooke's joint, the angles of the driving and driven shafts with the inter-mediate shaft are each equal to 20^0. The driving shaft is rotating at 500 rpm. If the forks of the intermediate shaft lie in a plane perpendicular to each other, find the maximum and minimum speeds of the driven shaft. [4+6]

OR

7.a) Draw a neat sketch of the Davis steering gear, and show that it exactly satisfies the condition for correct steering.

b) Sketch and explain the working of a Tchebicheff straight line motion mechanism. [5+5]

8.a) Derive the expressions for the displacement, velocity, and acceleration for a tangent cam operating a reciprocating roller follower when the roller has contact with the straight flanks.

b) Draw the displacement, velocity and acceleration diagrams for a follower when it moves with uniform and equal acceleration and retardation. [7+3]

OR

9. Draw the profile of a cam for the follower motion prescribed below: Roller follower of 3 cm diameter; roller moves outward with SHM during 160^0 of cam rotation; it rests for 20^0 of cam rotation; Returns with uniform and unequal acceleration and retardation, the retardation being double the acceleration, during 160^0 of cam rotation; it dwells for the remaining period of cam rotation. Minimum radius of the cam is 5 cm and maximum lift of the follower is 4 cm. The cam rotates at a uniform speed in *cw* direction, and the line of stroke of the follower passes through the axis of cam. [10]

10.a) A pair of involute gears with 16^0 pressure angle and 6 mm module is in mesh. The number of teeth on the pinion is 16, and its rotational speed is 240 rpm. If the gear ratio is 1.75, find the addenda on pinion and gear wheel in order that interference is just avoided.

b) Two parallel shafts are to be connected by spur gears. The shafts are 600 mm apart approximately. Speed of one shaft is 360 rpm, and that of the other is 120 rpm. The circular pitch is 25 mm. Find the pitch circle diameters of the gears. [6+4]

OR

11.a) Define and explain the following terms with respect to helical gears: helix angle, circular pitch, normal circular pitch. How are the three terms related to each other?

b) In an epicyclic gear train shown in figure 2, the number of teeth on wheels A, B and C are 50, 25, and 52 respectively. If the arm rotates at 420 rpm ccw, find the speed of wheel C when A is fixed. [5+5]

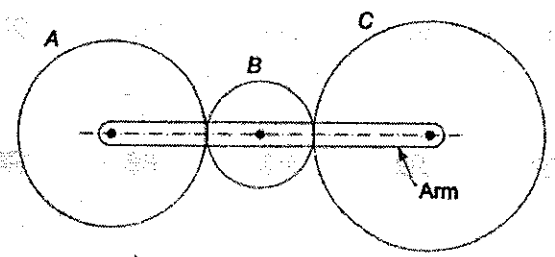

Figure: 2

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