CBCS SCHEME

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20MMD15

First Semester M.Tech. Degree Examination, Jan./Feb. 2021
Dynamics and Mechanism Design

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define kinematic inversion. Name and sketch all the inversions of 4-bar chain. **(05 Marks)**

b. Define mobility of a mechanism. Obtain the Kutzback mobility criterion. **(05 Marks)**

c. Define transmission angle of a 4 bar mechanism. Obtain the expression for the same interms of link dimensions. Also obtain the condition for its maximum value. Sketch the linkage position at maximum transmission angle. **(10 Marks)**

OR

2 a. Differentiate between planer, spherical and spatial mechanisms. **(12 Marks)**

b. With a neat figure, explain the Auxillary point method using rotated velocity vector. **(08 Marks)**

Module-2

3 a. Differentiate between Holonomic and non-holonomic constraints with examples. **(06 Marks)**

b. Explain the principle of vertical work. **(04 Marks)**

c. A simple mechanical system as shown in Fig.Q3(c) consists of two frictionless blocks of equal mass (m) are connected by a massless rigid rod. Using principle of virtual work, determine the force F, if the system is in static equilibrium.

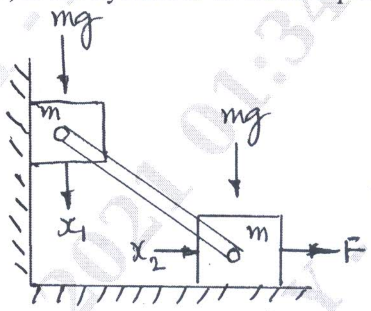

Fig.Q3(c) **(10 Marks)**

OR

4 a. Write the standard form of Lagrange's equation for a holonomic system. Mention the various terms involved in it. **(04 Marks)**

b. A block of mass (m_2) which slides on another block of mass (m_1) which in turn slides on a horizontal surface as shown in Fig.Q4(b). Using Lagrange's equation and x_1, x_2 coordinates obtain the differential equation of motion.

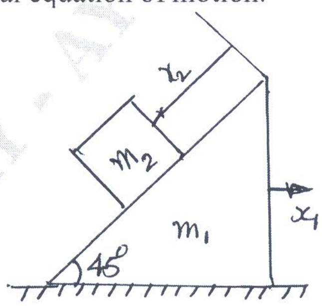

Fig.Q4(b) **(08 Marks)**

c. Find the equation of motion for the system shown in Fig.Q4(c) using Lagrange's equation (assume small oscillation)

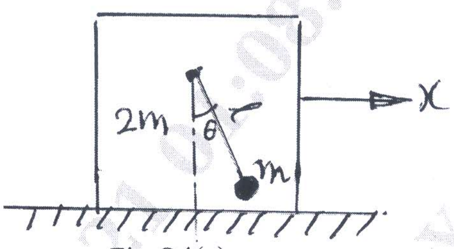

Fig.Q4(c) **(08 Marks)**

Module-3

5 a. Explain function generation, path generation and body guidance. **(06 Marks)**

b. Design a 4-bar mechanism to generate a function $y = x^{1.5}$ in the range $1 \le x \le 4$ using Chebyshev spacing for three precision points. Take $\varphi_s = 30°$ $\psi_s = 90°$ and $\Delta\varphi = \Delta\psi = 90°$. Assume the length of fixed link as 100 mm. **(14 Marks)**

OR

6 a. Explain with suitable sketch the pole of a rotating link. **(06 Marks)**

b. Locate the relative pole for a slider crank mechanism. Use proportionate dimensions for links of a mechanisms. Briefly explain the stepwise procedure. **(14 Marks)**

Module-4

7 a. Describe the two position synthesis of Crank-Rocker mechanism with suitable diagram. **(10 Marks)**

b. Give a brief procedure for overlay method of synthesis. **(10 Marks)**

OR

8 a. Derive the Frendenstein's equation for 4-bar linkage. **(10 Marks)**

b. Synthesis a 4-bar linkage to give the following values for angular velocities and accelerations. Use Bloch's method of synthesis.
$\omega_2 = 200$ rad/sec; $\omega_3 = 85$ rad/sec; $\omega_4 = 130$ rad/sec; $\alpha_2 = 0$, $\alpha_3 = -1000$ rad/sec^2, $\alpha_4 = -16000$ rad/sec^2. Sketch the mechanism (adopt scale 1×10^6 units = 25 mm). **(10 Marks)**

Module-5

9 a. Explain gyroscopic action in systems. **(10 Marks)**

b. Derive Eular-Lagrange's equation of motion. **(10 Marks)**

OR

10 Write short notes on any four of the following:

a. Generalized coordinates
b. Hamilton principle
c. Poles and relative poles
d. 4-position synthesis
e. Kinematic analysis by Goodman's indirect method
f. Eularian angles **(20 Marks)**

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