Reg. No.															

Question Paper Code	13341

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024 (JAN - 2025)

First Semester

M.E - CAD/CAM

24PCDMA101 - OPTIMIZATION TECHNIQUES IN DESIGN

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What is the principles of optimization and write its elements?	2	K1	CO1
2.	Outline difference between Fibonacci and golden section methods.	2	K2	CO1
3.	Distinguish between Direct and Indirect methods of Constrained Optimization.	2	K2	CO2
4.	What are Euler–Lagrange equations?	2	K1	CO2
5.	State two engineering examples of serial systems that can be solved by dynamic programming.	2	K2	CO3
6.	What are the basic operations used in Genetic algorithms?	2	K1	CO3
7.	Define transverse load. Give any two examples.	2	K1	CO4
8.	Define parametric constraints.	2	K1	CO4
9.	Define mechanism.	2	K1	CO5
10.	Explain about degrees of freedom.	2	K2	CO5

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11.	a)	Solve the following problem by applying the Kuhn-Tucker conditions Minimum $Z = 2x_1 + x_1x_2 + 3x_2$ Subject to $x_1^2 + x_2 \geq 3$	13	K3	CO1
		OR			
	b)	Prove that a convex function is unimodal.	13	K3	CO1
12.	a)	Prove that the shortest distance between two points is a straight line. Show that the necessary conditions yield a minimum and not a maximum.	13	K3	CO2
		OR			
	b)	Derive the necessary conditions of optimality and find the solution for the following problem: Minimize $f(x) = 5x_1x_2$ Subject to $25 - x_1^2 - x_2^2 \geq 0$	13	K3	CO2

13. a) Identify how the Dynamic programming has been applied to solve the following types of engineering problems. *13 K3 CO3*
(a) Design of Continuous Beam.
(b) Optimal Layout (Geometry) of a Truss.

OR

b) Two discrete fuzzy sets, A and B are defined as follows: *13 K3 CO3*
A = {(60, 0.1) (62, 0.5) (64, 0.7) (66, 0.9) (68, 1.0) (70, 0.8) }
B = { (60, 0.0) (62, 0.2) (64, 0.4) (66, 0.8) (68, 0.9) (70, 1.0) }
Determine the union and intersection of these sets.

14. a) Derive the expression for torsional rigidity of the shaft. *13 K3 CO4*

OR

b) A shaft is transmitting 100 kW at 160 rpm. Find a suitable diameter for the shaft, if the maximum torque transmitted exceeds the mean by 25%. Take maximum allowable shear stress as 70 MPa. *13 K3 CO4*

15. a) A uniform column of rectangular cross section (b X d) is to be constructed for supporting a water tank of mass 'M'. It is required to minimize the mass of the column for economy, and to maximize the natural frequency of transverse vibration of the system for avoiding possible resonance due to wind. Formulate the problem of designing the column to avoid failure due to direct compression and buckling. Assume all other relevant data. *13 K3 CO5*

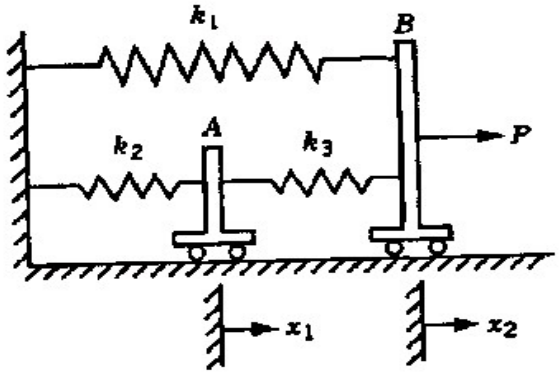
OR

b) i) Develop and write about vibration absorbers and the need of optimization in their design. *7 K3 CO5*

ii) Formulate an optimization problem for slider crank mechanism. *6 K3 CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Figure below shows two frictionless rigid bodies (carts) A and B connected by three linear elastic springs having spring constants k1 , k2 and k3 . The springs are at their natural positions when the applied force P is zero. Find the optimal solution of displacements x1 and x2 under the force P by using the principle of minimum potential energy. *15 K3 CO4*



OR

b) Find the minimum volume design of the cone clutch shown in Fig. such that it can transmit a specified minimum torque. *15 K3 CO4*