Reg. No.																

Question Paper Code	13575

M.E. - DEGREE EXAMINATIONS, APRIL / MAY 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.	List three reasons why the study of unconstrained minimization methods is important.	2	K1	CO1
2.	Differentiate single variable and multi variable optimization.	2	K2	CO1
3.	Recall the limitations of direct methods in optimization.	2	K1	CO2
4.	How can you compute Lagrange multipliers during numerical optimization?	2	K1	CO2
5.	What are the basic operations used in genetic algorithm?	2	K1	CO3
6.	How is the output of a neuron described commonly?	2	K1	CO3
7.	List the assumptions in design of a truss.	2	K1	CO4
8.	Name any two machine members where torsional loads may cause failure.	2	K1	CO4
9.	Define degree of freedom with a suitable example.	2	K1	CO5
10.	Differentiate mechanism and inversion.	2	K2	CO5

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Explain the classifications of optimization problems in detail. *13 K2 CO1*

OR

b) With the help of a simple problem , Outline the principle of golden section method with an example. Highlight its computational efficiency and merits over other methods. *13 K2 CO1*

12. a) Minimize $f(x) = x_1^2 + x_2^2 + 6x_1 - 8x_2 + 10$ *13 K3 CO2*

subject to,

$4x_1 + x_2^2 \leq 16$

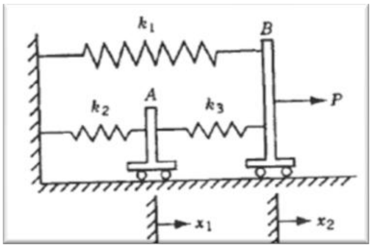
$3x_1 + 5x_2 \leq 15$

$x_i > 0$, I = 1,2

by using the interior penalty function method with the starting point $x_1 = \begin{Bmatrix} 1 \\ 1 \end{Bmatrix}$.

OR

	b)	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*
13.	a)	Construct the working principles of Genetic Algorithms (GA) using an unconstrained optimization problem as an example. Compare GA with traditional methods.	*13*	*K3*	*CO3*
		OR			
	b)	Solve the objective function using simulated annealing Minimize $f(x_1,x_2) = (x_1^2+x_2-11)^2 + (x_1^2+x_2-7)^2$	*13*	*K3*	*CO3*
14.	a)	Describe the torsion equation for a shaft and also derive its expression through suitable method.	*13*	*K3*	*CO4*
		OR			
	b)	Figure below shows two frictionless rigid bodies (carts) A and B connected by three linear elastic springs having spring constants k_1 , k2 and k_3.The springs are at their natural positions when the applied force P is zero. Find the optimal solution of displacements x_1 and x_2 under the force P by using the principle of minimum potential energy.	*13*	*K3*	*CO4*



15.	a)	Build the principles involved in designing a cone clutch systems under the aspect of optimization to minimize its volume, with suitable example.	*13*	*K3*	*CO5*
		OR			
	b)	Consider a slider crank mechanism and explain its design methodology. Identify the parameters to be optimized and propose the techniques to solve the problem.	*13*	*K3*	*CO5*

PART - C (1 × 15 = 15 Marks)

16.	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.	*15*	*K3*	*CO5*
		OR			
	b) (i)	Develop and write about vibration absorbers and the need of optimization in their design.	*6*	*K3*	*CO5*
	(ii)	Describe about optimization of truss with suitable example.	*9*	*K3*	*CO5*