Reg. No.												

Question Paper Code	21309

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

First Semester

M.E. - CAD/CAM

20PCDMA101 - OPTIMIZATION TECHNIQUES IN DESIGN

(Regulations 2020)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level,CO
1.	Explain the principles of optimization and write its elements.	*2,K2,CO1*
2.	Explain unconstraint minimization problem and write few methods for solving it.	*2,K2,CO1*
3.	Explain geometric interpretation of the reduced gradient.	*2,K2,CO2*
4.	Define Multi stage optimization.	*2,K1,CO2*
5.	Explain why are the components numbered in reverse order in dynamic Programming.	*2,K2,CO3*
6.	Explain about a neural network.	*2,K2,CO3*
7.	Define longitudinal load. Give any two examples.	*2,K1,CO4*
8.	List the various stresses induced in shaft.	*2,K1,CO4*
9.	Define dynamics.	*2,K1,CO5*
10.	Explain about mechanism.	*2,K2,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Find the minimum of $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ by the cubic interpolation method. *13,K3,CO1*

OR

b) Prove that a convex function is unimodal. *13,K3,CO1*

12. a) Solve the following LP problem by Dynamic Programming: *13,K3,CO2*

Maximize $f(x_1, x_2) = 10x_1 + 8x_2$

Subject to $2x_1 + x_2 \leq 25$

$3x_1 + 2x_2 \leq 45$

$x_2 \leq 10$

And

$x_1 \geq 0, \quad x_2 \geq 0$

OR

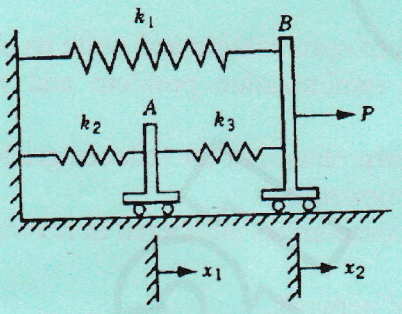
b) Explain in detail the relation between the sequential quadratic programming method and the Lagrangian function *13,K2,CO2*

13. a) 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

OR

b) Find the minimum of the following function using simulated annealing: f (X) = $6x_1^2 + 2x_2^2 - x_1 - 2x_2 - 6x_1x_2$. Assume suitable parameters and show detailed calculations for 2 iterations. *13,K3,CO3*

14. 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. *13,K3,CO4*



OR

b) (i) State the relation for efficiency of a screw jack and identify the contributing factors. Also find the optimal value of each factor. *8,K3,CO4*
(ii) During the design of structural members, safety is more important than optimization. Comment. *5,K3,CO4*

15. a) Formulate an optimization problem and Find the link lengths of the four-bar linkage for minimum structural error. *13,K3,CO5*

OR

b) Write about vibration absorbers and the need of optimization in their design. *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Minimize the function *15,K3,CO1*

$$f(\lambda) = 0.65 - \frac{0.75}{1+\lambda^2} - 0.65\,\lambda\, tan^{-1}\frac{1}{\lambda}$$

Using the Golden Section method with n = 6. Formulate the optimization problem and suggest the suitable solution techniques.

OR

b) Find the minimum of the function *15,K3,CO1*

$$f(\lambda) = 0.65 - \frac{0.75}{1+\lambda^2} - 0.65\,\lambda\, tan^{-1}\frac{1}{\lambda}$$

by Newton Raphson method with the string point $\lambda_1 = 0.1$