NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR
Odd Semester Mid-Term Examination, 2023-24

Course Code: CEO 540 Full Marks: 25

Course Name: Numerical Methods in Engineering Time: 90 Minutes

Instructions: Answer all the questions.
Programmable scientific calculators are not allowed

Question No.	Body of the Question	Marks	Mapped CO
1	a. What are the major sources of errors in numerical computation? Explain briefly. b. What is absolute and relative error? c. Find out the absolute and relative errors, where the actual and measured values are 252.14 mm and 249.02 mm. d. If Δx and Δy are the absolute errors with estimates 0.005 and 0.001 respectively in $x= 2.3$ and $y=4.5$, then compute the relative error in the computation of $(x+y)$. e. Round-off the number 0.000014368 to four significant figures.	5	CO1
2	Find the following system of equations and solve them using LU Decomposition Method. $6x + 18y + 3z = 3$ $2x + 12y + z = 19$ $4x + 15y + 3z = 0$	5	CO2
3	Solve the following system of equations using Gauss-Seidel method for three iterations. Keep the solution till four digits after decimal. Comment on diagonal dominance of the matrix. $10x - y + 3z = 7$ $x + 11y - 5z = 5$ $2x - y + 13z = 8$	5	CO2
4	a. Derive root calculation using Regula Falsi method using neat illustrations. b. An independent variable x can be represented as a cubic root of 48. Find x using Regula Falsi method, start your assumptions with x=1. Compute the approximate root till four digits after decimal point. Use four iterations for solving the problem.	5 (1+4)	CO4
5	a. Derive the root estimation expression for Newton-Raphson Method. b. Use Newton Raphson Method to solve the equation: $f(x)= 2x^2+5-e^x$. Use x=0 as starting point. Approximate root should be estimated with four digits after decimal point. Use four iterations for solving the problem.	5 (1+4)	CO3

Course Outcomes
CO1: Assess the error involved in a numerical method
CO2: Solve problems in engineering and science with a required accuracy using appropriate numerical methods
CO3: Write algorithm for the numerical methods for efficient coding of program
CO4: Understand the mathematics concepts underlying the numerical methods

NITDGP/BTECH/Reg/Odd/2023-24

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Odd Semester Mid-Term Examination, 2023-24

Course Code: CEO 741 | Full Marks: 25

Course Name: OPTIMIZATION IN ENGINEERING DESIGN | Time: 90 Minutes

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Instructions: Figures in the margin indicate full marks. Answer *all* questions.

Use of mm graph sheet is mandatory. Representative plot of graphs in white papers fetches zero marks and will be considered a corrupt answer. Calculation of points for drawing the graphs must be presented; else, zero marks will be awarded. The questions from (a) to (g) are interlinked with each other and accordingly a wrong answer at some point will fetch zero marks for that and subsequent remaining questions.

Question No.	Body of the Question	Marks	Mapped CO
	Objective function: $Z = 3x_1 + 2x_2$ Constraint functions: $3x_1 + x_2 \geq 11$ $x_1 + 3x_2 \geq 9$ $x_1 - x_2 \leq 5$ $5x_1 + 3x_2 \leq 57$ $-x_1 + 3x_2 \leq 21$ $3x_1 - x_2 \geq 1$ $x_1 \geq 0,\ x_2 \geq 0$		
(a)	Plot the constraints in a graph sheet.	4	CO2
(b)	Identify the feasible region. Is it convex or concave? Why?	3	CO2
(c)	Plot the objective function.	1	CO2
(d)	Will a maximization problem or a minimization problem or both be feasible for the said objective function and the feasible region? Why?	2	CO2
(e)	Will there be unique or alternate optima for either and/or both cases and why?	2	CO2
(f)	What are the optima in either and/or both cases and corresponding objective function values?	2	CO2
(g)	Express either and/or both optimization problems in their respective standard forms, and also in canonical forms.	4	CO2
(h)	Write a note on two-phase simplex method.	2	CO2
(i)	Explain pivot operations, ratio test, pricing operation, and optimality criteria for maximization and minimization in LPP.	5	CO2

Course Outcomes

CO1: Develop optimization models for any engineering system.

CO2: Solve optimization problems.

CO3: To learn about modern optimization methods