

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

MTech-I Semester (Structural Engineering)

COURSE CODE (CREDITS): 25M1WCE131 (3)

MAX. MARKS: 25

COURSE NAME: MODELLING, SIMULATION AND COMPUTER APPLICATIONS

COURSE INSTRUCTORS: Dr. Tanmay Gupta

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems, Use of scientific calculator is allowed

Q.No	Question	CO	Marks												
Q1	A floating ball has a specific gravity of 0.6 and has a radius of 5.5 cm. Find the depth to which the ball is submerged when floating in water (x). The equation that gives the depth x to which the ball is submerged under water is given by $f(x) = x^3 - 0.163x^2 + 3.993 \times 10^{-4}$. Use the Secant method of finding roots of equations to find the depth x to which the ball is submerged under water. Conduct three iterations to estimate the root of the above equation.	2	6												
Q2	Consider a simplified structural system subjected to a suddenly applied constant force. The equation of motion governing the structure's displacement is $\frac{d^2y}{dt^2} + y = 1$ The structure is initially at rest, $y(0) = 0$ and $y'(0) = 0$ Using the Laplace Transform method , find the displacement.	3	6												
Q.3	In a beam loading experiment, the following data was recorded: <table><tr><th>Load, x (kN)</th><th>Deflection, y (mm)</th></tr><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>5</td></tr><tr><td>3</td><td>11</td></tr><tr><td>4</td><td>8</td></tr><tr><td>5</td><td>14</td></tr></table> Using the method of least squares , find the linear equation that best fits this experimental data.	Load, x (kN)	Deflection, y (mm)	1	1	2	5	3	11	4	8	5	14	3	4
Load, x (kN)	Deflection, y (mm)														
1	1														
2	5														
3	11														
4	8														
5	14														
Q.4	A construction firm wants to maximize its profit by building two types of pre-fabricated structures: Type A (x_1) and Type B (x_2). The project is limited by available man-hours, machine-hours, and a specific raw material. The problem is formulated as the following Linear Programming Problem (LPP): • Maximize Profit (z): $3x_1 + 2x_2$ • Subject to resource constraints: ○ $3x_1 + x_2 \leq 12$ (Man-hours) ○ $x_1 + x_2 \leq 6$ (Machine-hours) ○ $5x_1 + 3x_2 \leq 27$ (Raw material)	4	9												

	(a) Write the dual of this problem. (b) Solve for the optimal number of each structure type using the regular Simplex method. (c) Solve the dual problem using the dual Simplex method. (d) Compare the resulting sequence of basic solutions from both methods.		
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