JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST - 3 EXAMINATION (December 2025)
B.Tech. - III Semester (ECE-VLSI)

COURSE CODE (CREDITS): 25B11MA312 (2) MAX. MARKS: 35
COURSE NAME: NUMERICAL TECHNIQUES
COURSE INSTRUCTORS: RKB* MAX. TIME: 2 Hours.

Note: All questions are compulsory. Use of scientific calculator is allowed. The candidate is allowed to make suitable numeric assumptions wherever required for solving problems.

Q.No	Question	CO	Marks
Q1	If for a transistor, the node-voltage equation reduces to a polynomial like $x^3 + 5x - 4 = 0$ after non-dimensionalization. Solve the polynomial using Newton-Raphson method correct to 3 decimal places to find the node voltage (normalized) at the DC operating point needed before analyzing small-signal behavior or designing bias networks.	CO-1	5
Q2	The rainfall intensity (in mm/hr) on a construction site varies over time and is modeled by the function: $R(t) = 0.5 + 0.8t + 0.2t^2, 0 \le t \le 6$. Using Simpson's 3/8 rule with $n = 6$ equal intervals, estimate the total rainfall $\int_0^6 R(t)dt$ (in mm) over the period of 6 hrs.	CO-3	5
Q3	In VLSI cell characterization, both the value of a function (delay) and its slope (sensitivity to input slew) are often required. Suppose the measured propagation delay $f(x)$ of a logic gate (in ns) at different input transition times (slew, in ns) and its slopes are given as: x | $f(x)$ | $f'(x)$ 1 | 0.15 | 0.11 1.5 | 0.25 | 0.17 Use Hermite interpolation to estimate the propagation delay at an input slew of $x = 1.2$.	CO-3	5
Q4	A small resistive interconnect between three nodes leads to the nodal equations for node voltages as follows: $2x + y + z = 7$ $x + 2y + z = 8$ $x + y + 2z = 9$ where the coefficients are conductances in mS; RHS are injected currents in mA-typical small-signal nodal system in VLSI analysis. Solve for x, y and z using LU decomposition.	CO-3	5
Q5	Solve the following system of linear equations using Gauss Seidel iterative method: $15x_1 - 3x_2 - x_3 = 10$ $-3x_1 + 10x_2 - 2x_3 = 5$ $-x_1 - 2x_2 + 8x_3 = 7.$	CO-3	5
Q6	Using Runge Kutta method of order 4, solve the initial value problem $\frac{dy}{dx} = x^2(1 + y); y(0) = 1$ finding y for $x = 0.1, 0.2$ and 0.3.	CO-4	6
Q7	Use Milne Predictor and corrector formula to estimate the value of y for $x = 0.4$, based on the values of $y(0.1), y(0.2), y(0.3)$ obtained in question no 6.	CO-4	4

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