JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST - 2 EXAMINATION (October 2025)
B.Tech. - III Semester (CE)

COURSE CODE (CREDITS): 18B11MA311 (3) MAX. MARKS: 25
COURSE NAME: NUMERICAL METHODS
COURSE INSTRUCTORS: RKB* MAX. TIME: 1 Hr 30 Mins.

***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.*

<table>
<tr><th>Q.No</th><th>Question</th><th>CO</th><th>Marks</th></tr>
<tr><td>Q1</td><td>Suppose that we are using a computer with a fixed word length of 5 digits. Evaluate the error due to rounding in representing the number 0.00345672. Also compute the relative error.</td><td>CO-1</td><td>2</td></tr>
<tr><td>Q2</td><td>Suppose we have measured the compressive strength of a concrete mix (in MPa) at different curing temp (in °C). The measured values are:
<table>
<tr><td>Curing Temperature (°C)</td><td>20</td><td>25</td><td>30</td></tr>
<tr><td>Compressive Strength (MPa)</td><td>28</td><td>32</td><td>40</td></tr>
</table>
Using Lagrange Interpolation, estimate the compressive strength of the concrete at a curing temperature of 27 °C.</td><td>CO-2</td><td>3</td></tr>
<tr><td>Q3</td><td>In concrete technology, the setting time of a cement paste is often measured at different water-cement (w/c) ratios. The following table shows the measured initial setting time (in hours) for various w/c ratios.
Using Newton's Forward Interpolation, estimate the initial setting time at a water-cement ratio of 0.48.
<table>
<tr><td>Water-Cement Ratio</td><td>0.40</td><td>0.45</td><td>0.50</td><td>0.55</td></tr>
<tr><td>Initial Setting Time (hrs)</td><td>2.5</td><td>3.0</td><td>3.8</td><td>4.5</td></tr>
</table></td><td>CO-2</td><td>5</td></tr>
<tr><td>Q4</td><td>Using Stirling's interpolation technique, evaluate the value of $f(16)$ on the basis of the following observations recorded:
<table>
<tr><td>x</td><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td><td>30</td></tr>
<tr><td>f(x)</td><td>0.0</td><td>0.0875</td><td>0.1763</td><td>0.2679</td><td>0.3640</td><td>0.4663</td><td>0.5774</td></tr>
</table></td><td>CO-2</td><td>5</td></tr>
<tr><td>Q5</td><td>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:
<table>
<tr><td>x</td><td>$f(x)$</td><td>$f'(x)$</td></tr>
<tr><td>1</td><td>0.20</td><td>0.12</td></tr>
<tr><td>1.5</td><td>0.35</td><td>0.18</td></tr>
</table>
Use Hermite interpolation to estimate the propagation delay at an input slew of $x = 1.2$.</td><td>CO-3</td><td>5</td></tr>
<tr><td>Q6</td><td>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.</td><td>CO-3</td><td>5</td></tr>
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