PVP 23

Code: 23BS1303

II B.Tech - I Semester – Regular / Supplementary Examinations NOVEMBER 2025

NUMERICAL METHODS AND TRANSFORM TECHNIQUES (MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1. a)	Explain Bisection method.	L2	CO1
b)	Obtain an iterative formula to find the root of $\sqrt[3]{N}$ by Newton Raphson Method.	L3	CO1
c)	Find the first derivative of Newton's forward interpolation formula at $x = x_0$	L1	CO2
d)	Evaluate $\int_0^3 \frac{dx}{1+x^2}$ by trapezoidal Rule.	L3	CO2
e)	State the Taylor's series method formula.	L1	CO2
f)	Solve the differential equation with the given conditions by Picard's method. $\frac{dy}{dx} = 1 + xy$, y_0=1 when x_0=0 up to y_2.	L3	CO2
g)	State and prove the first shifting property.	L3	CO3
h)	Find L$\{t^2 e^{2t}\}$	L1	CO3
i)	Explain Dirichlet's conditions.	L2	CO5
j)	Find a_0 if $f(x) = x^2$ in the $interval$ $(0,2\pi)$	L1	CO5

	using Fourier series.		

PART – B

<table>
<tr><td></td><td></td><td></td><td>BL</td><td>CO</td><td>Max. Marks</td></tr>
<tr><td colspan="6">UNIT-I</td></tr>
<tr><td rowspan="2">2</td><td>a)</td><td>Determine a positive root of $x^3 - 4x + 1 = 0$, correct up to three decimal places by using Regula-falsi method.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td>b)</td><td>Obtain the missing terms in the following table.
<table>
<tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Y</td><td>2</td><td>4</td><td>8</td><td>-</td><td>32</td><td>-</td><td>128</td><td>256</td></tr>
</table></td><td>L4</td><td>CO2</td><td>5 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>3</td><td colspan="2">From the following table estimate the number of students who obtained marks between 40 and 45 using Newton’s forward interpolation formula.
<table>
<tr><td>Marks</td><td>30-40</td><td>40-50</td><td>50-60</td><td>60-70</td><td>70-80</td></tr>
<tr><td>Number of students</td><td>31</td><td>42</td><td>51</td><td>35</td><td>31</td></tr>
</table></td><td>L3</td><td>CO4</td><td>10 M</td></tr>
<tr><td colspan="6">UNIT-II</td></tr>
<tr><td>4</td><td colspan="2">Find $\frac{dy}{dx}, \frac{d^2y}{dx^2}$ at x=1.1 and at x=1.6 for the following table given below.
<table>
<tr><td>X</td><td>1.0</td><td>1.1</td><td>1.2</td><td>1.3</td><td>1.4</td><td>1.5</td><td>1.6</td></tr>
<tr><td>Y</td><td>7.989</td><td>8.403</td><td>8.781</td><td>9.129</td><td>9.451</td><td>9.750</td><td>10.031</td></tr>
</table></td><td>L3</td><td>CO2</td><td>10 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>5</td><td>a)</td><td>A rocket is launched from the ground. Its acceleration is registered during the first 80</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
</table>

<table>
<tr><td></td><td></td><td>seconds and is given as follows:
<table><tr><th>t(s)</th><th>0</th><th>10</th><th>20</th><th>30</th><th>40</th><th>50</th><th>60</th><th>70</th><th>80</th></tr><tr><td>a(m/s^2)</td><td>30</td><td>31.63</td><td>33.34</td><td>35.47</td><td>37.75</td><td>40.33</td><td>43.25</td><td>46.69</td><td>50.67</td></tr></table>By $Simpson's\ \frac{1}{3}rd$ rule, find the velocity at t=80 sec.</td><td></td><td></td><td></td></tr>
<tr><td></td><td>b)</td><td>Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Weddle’s Rule.</td><td>L4</td><td>CO4</td><td>5 M</td></tr>
<tr><td colspan="6" align="center">UNIT-III</td></tr>
<tr><td>6</td><td colspan="2">Apply Milne’s method to find the solution of the differential quation $y' = x - y^2\ in\ the\ range\ 0 \le x \le 1$ for the condition y(0)=0, h = 0.2.</td><td>L3</td><td>CO2</td><td>10 M</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>7</td><td>a)</td><td>Apply the Runge-Kutta method of fourth order to find an approximate value of y at x=0.1 if $\frac{dy}{dx} = x + y^2$, given that y=1 when x=0 in steps of h=0.1</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td></td><td>b)</td><td>Using modified Euler’s method to find the value of y satisfying the equation $\frac{dy}{dx} = \log(x + y)$ for x=1.2, correct up to four decimal places by taking h=0.2. Given that y(1)=2.</td><td>L4</td><td>CO4</td><td>5 M</td></tr>
<tr><td colspan="6" align="center">UNIT-IV</td></tr>
<tr><td>8</td><td>a)</td><td>Determine the inverse Laplace transform of</td><td>L3</td><td>CO3</td><td>5 M</td></tr>
</table>

		$\left\{\frac{4s+15}{16s^2-25}\right\}$ using partial fractions.			
	b)	Evaluate $L\{te^t sint\}$	L4	CO3	5 M
OR					
9	a)	Evaluate the Laplace transform of $\frac{cosat-cosbt}{t}$	L3	CO3	5 M
	b)	Evaluate the inverse Laplace transform of $log\left(\frac{s+1}{s-1}\right)$	L3	CO3	5 M
UNIT-V					
10	Express $f(x) = \lvert x \rvert, -\pi < x < \pi$ in a Fourier series. Hence deduce $$\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots$$		L3	CO5	10 M
OR					
11	Find the Fourier transform of $$f(x) = \begin{cases} a - \lvert x \rvert, & \lvert x \rvert \le a \\ 0, & \lvert x \rvert > a \end{cases}$$ Hence show that $\int_0^\infty \frac{sin^2 x}{x^2} dx = \frac{\pi}{2}$		L4	CO5	10 M