PVP 23

Code: 23BS1303

II B.Tech - I Semester – Regular Examinations - DECEMBER 2024

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)	If the first two approximations x_0 and x_1 are roots of $x^3 - x - 4 = 0$ are 1 and 2, then find x_3 by bisection method.	L2	CO1
1.b)	Write the Lagrange's interpolation formula for y = f(x).	L2	CO1
1.c)	Write first and second order derivatives using Newton's forward ward difference formula at $x = x_0$.	L2	CO1
1.d)	Write boole's rule.	L2	CO1
1.e)	Write the formula for Picard's method of successive approximation.	L2	CO1
1.f)	Explain Euler's method.	L2	CO1
1.g)	Find the Laplace transform of $e^{2t}(cos^2 t)$.	L3	CO3
1.h)	Find the inverse Laplace transform of $\frac{s+3}{s^2-4s+13}$	L3	CO3
1.i)	If $f(x) = sinx$ in $(-\pi, \pi)$, then find b_1.	L2	CO1
1.j)	Find the Fourier sine transform of $f(x) = e^{-x}$.	L2	CO1

PART – B

<table>
<tr><th></th><th></th><th></th><th>BL</th><th>CO</th><th>Max. Marks</th></tr>
<tr><td colspan="6">UNIT-I</td></tr>
<tr><td rowspan="2">2</td><td>a)</td><td>Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position correct to three decimal places.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td>b)</td><td>Using Newton-Raphson method, find the real root of $xlog_{10}x = 1.2$ correct to five decimal places.</td><td>L3</td><td>CO2</td><td>5 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>3</td><td colspan="2">Find y(1) and y(10) using Newton's interpolation formulae for the data.
<table>
<tr><td>x:</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr>
<tr><td>y:</td><td>4.8</td><td>8.4</td><td>14.5</td><td>23.6</td><td>36.2</td><td>52.8</td><td>73.9</td></tr>
</table></td><td>L4</td><td>CO4</td><td>10 M</td></tr>
<tr><td colspan="6">UNIT-II</td></tr>
<tr><td>4</td><td colspan="2">Given that
<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>
Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.6$.</td><td>L4</td><td>CO4</td><td>10 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>5</td><td colspan="2">Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using
(i)Trapezoidal rule (ii) Simpson's 1/3 rule
(iii) Simpson's 3/8 rule (iv) Weddle's rule.</td><td>L3</td><td>CO2</td><td>10 M</td></tr>
</table>

		UNIT-III			
6	a)	Using Euler's method solve for y at x = 0.1 from $\frac{dy}{dx} = x + y + xy, y(0) = 1$, taking step size h = 0.025.	L3	CO2	5 M
	b)	Using Runge-Kutta method of fourth, solve $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$ with y (0) = 1 at x = 0.2.	L3	CO2	5 M
		OR			
7		Using Taylor's series method, find y at $x = 0.1, 0.2, 0.3$ given that $\frac{dy}{dx} = xy + y^2, y(0) = 1$. Continue the solution at $x = 0.4$ using Milne's method.	L3	CO2	10 M
		UNIT-IV			
8	a)	Find the Laplace transform of $f(t) = \begin{cases} 1, & 0 \le t \le 1 \\ t, & 1 < t \le 2 \\ 0, & t > 2 \end{cases}$.	L3	CO3	5 M
	b)	Using unit step function, find the Laplace transform of $f(t) = \begin{cases} sint, & 0 \le t < \pi \\ \sin 2t, & \pi \le t < 2\pi \\ \sin 3t, & t \ge 2\pi \end{cases}$	L3	CO3	5 M
		OR			

9	a)	Find inverse Laplace transform of $\frac{2s^2-6s+5}{(s^3-6s^2+11s-6)}$.	L3	CO3	5 M
	b)	Find the inverse Laplace transform of $\frac{1}{s(s+a)^3}$.	L3	CO3	5 M
UNIT-V					
10	a)	Obtain the Fourier series of the function $f(x) = \begin{cases} \pi x, if\ 0 \le x \le 1 \\ \pi(2-x), 1 \le x < 2 \end{cases}$	L4	CO5	5 M
	b)	Find the half-range cosine series expansion of $f(x) = x^2$ in the range $0 \le x \le \pi$.	L4	CO5	5 M
OR					
11	a)	Using the Fourier integral representation, show that $\int_0^\infty \frac{\omega\ sinx\omega}{1+\omega^2} d\omega = \frac{\pi}{2} e^{-x} (x > 0)$.	L4	CO5	5 M
	b)	Find the Fourier transform of $e^{-a^2x^2}, a < 0$. Hence deduce that $e^{-\frac{x^2}{2}}$ is self reciprocal in respect of Fourier transform.	L4	CO5	5 M