PVP 23

Code: 23BS1303

II B.Tech - I Semester – Supplementary Examinations - MAY 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.

PART – A

1.a)	If the first two approximations x_0 and x_1 are roots of $x^3 - 2x - 5 = 0$ are 2 and 3, then find x_3 by regula falsi method.
b)	Write Newton's forward and backward interpolation formulas.
c)	Write first and second order derivatives using Newton's backward difference formula at $x = x_n$.
d)	$f(x)$ is given by, x | 0 | 0.5 | 1 $f(x)$ | 1 | 0.8 | 0.5 Then evaluate of $\int_0^1 f(x)dx$ by Trapezoidal rule.
e)	If $\frac{dy}{dx} = x - y, y(0) = 2, h = 0.2$, then find the value of y (0.2) using Euler's method.
f)	If $\frac{dy}{dx} = x + y^2, y(0) = 1$ and $h = 0.1$, then find the value of k_2 using Runge -Kutta method.

	g)	Find the Laplace transform of $e^{-3t}(2\ cos5t + 3sin5t)$
	h)	Find the inverse Laplace transform of $\frac{3(s^2-2)^2}{2s^5}$
	i)	If $f(x) = \|x\|$ in $(-\pi, \pi)$, then find a_0.
	j)	Find the Fourier cosine transform of $f(x) = e^{-5x}$.

PART – B

					Max. Marks
UNIT-I					
2	a)	By using the bisection method, find an approximate root of the equation $sinx = \frac{1}{x}$, that lies between $x = 1$ and $x = 1.5$. Carry out computations upto 5 th stage.			5 M
	b)	Find by Newton's method, the real root of the equation $3x = cosx + 1$.			5 M
OR					
3		From the following table, estimate the number of students who obtained marks between 40 and 45.			10 M

Marks	30-40	40-50	50-60	60-70	70-80
No. of Students	31	42	51	35	31

UNIT-II						
4	Find the first and second derivative of $f(x)$ at $x = 1.5$ if					10 M

x	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$	3.375	7.000	13.625	24.000	38.875	59.000

		OR	
5	a)	Use Simson's $\frac{1}{3}$ rd rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates.	5 M
	b)	Evaluate $\int_0^1 \frac{dx}{1+x}$ using boole's rule with four subintervals.	5 M
		UNIT-III	
6	a)	Employ Taylor's method to obtain approximate value of y at x = 0.2 for the differential equation $\frac{dy}{dx} = 2y + 3e^x, y(0) = 0$. Compare the numerical solution obtained with the exact solution.	5 M
	b)	Find the value of y for x = 0.1 by Picard's method, given that $\frac{dy}{dx} = \frac{y-x}{y+x}$, y (0) =1.	5 M
		OR	
7		Apply Milne's method, to find a solution of the differential equation $\frac{dy}{dx} = x - y^2$ in the range $0 \leq x \leq 1$ for the boundary condition y =0 and x = 0.	10 M
		UNIT-IV	
8	a)	Find the Laplace transform of $\left(\sqrt{t} - \frac{1}{\sqrt{t}}\right)^3$.	5 M
	b)	Evaluate $L\left\{e^{-t} \int_0^t \frac{sint}{t}\, dt\right\}$.	5 M
		OR	
9	a)	Find inverse Laplace transform of $\frac{5s+3}{(s-1)(s^2+2s+5)}$	5 M
	b)	Find the inverse Laplace transform of $\frac{s}{(s^2+a^2)^2}$.	5 M

UNIT-V			
10	a)	Find the Fourier series of the function $f(x) = \begin{cases} 0, if\ -\pi \le x \le 0 \\ sinx, if\ 0 \le x \le \pi \end{cases}$.	5 M
	b)	Find the half-range cosine series expansion of $f(x) = x\ in\ [0,2]$.	5 M
OR			
11	a)	Express $f(x) = f(x) = \begin{cases} 1, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$ as a Fourier sine integral and hence evaluate $\int_0^\infty \frac{1-cos(\pi\lambda)}{\lambda}\ sin(x\lambda)d\lambda$.	5 M
	b)	Find the Fourier sine transform of $\frac{e^{-ax}}{x}$.	5 M