

Second Semester B.E./B.Tech. Degree Examination, June/July 2026

Numerical Methods : CSE Stream

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks, L: Bloom's level, C: Course outcomes.
3. VTU Formula Hand Book is permitted.

Module – 1			M	L	C
Q.1	a.	Define Error, Absolute error, Relative error and Percentage errors.	6	L2	CO1
	b.	Using Newton Raphson method find the real root of $xe^x - 2 = 0$ correct to four decimal places.	7	L3	CO1
	c.	Using Bisection method find the real root of the equation $x^3 - 2x - 5 = 0$. Carry out 4 iterations.	7	L3	CO1
OR					
Q.2	a.	Round off the number 37.46235 to 4 significant figures and compute (i) Absolute error, (ii)Relative error (iii) percentage error	6	L2	CO1
	b.	Find a real root of the equation $x \log_{10} x - 1.2 = 0$ by regula falsi method correct to four decimal places.	7	L3	CO1
	c.	Using Secant method find the real root of the equation $x^3 + x^2 - 1 = 0$. Carry out 4 iterations.	7	L3	CO1
Module – 2					
Q.3	a.	Find the condition number of an invertible matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ with respect to L_1 norm.	5	L3	CO1
	b.	Apply LU Decomposition method to solve $x + y + z = 1$; $3x + y - 3z = 5$; $x - 2y - 5z = 10$	8	L3	CO1
	c.	Find the largest eigen value and eigen vector of the matrix A using Rayleigh's power method by taking the initial vector as $[1,1,1]'$ $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$	7	L3	CO1
OR					
Q.4	a.	Verify whether the following system of linear equations is well poised or not using spectral norm $\begin{bmatrix} 2.1 & 1.8 \\ 6.2 & 5.3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2.1 \\ 6.2 \end{bmatrix}$	6	L2	CO1
	b.	Solve by Gauss Seidel method $20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$. Carry out 5 iterations taking $X' = (1,1,1)$	7	L3	CO1

Q.4	c.	Using Jacobi's method find the approximate eigen values and eigen vectors of $A = \begin{bmatrix} 4 & 1 \\ 1 & 4 \end{bmatrix}$	7	L3	CO1
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Module – 3

Q.5	a.	From the following table find the number of students who obtained marks between 40 and 45	6	L3	CO1												
		<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>No of students</td><td>31</td><td>42</td><td>51</td><td>35</td><td>31</td></tr></table>	Marks	30-40	40-50	50-60	60-70	70-80	No of students	31	42	51	35	31			
Marks	30-40	40-50	50-60	60-70	70-80												
No of students	31	42	51	35	31												
	b.	Obtain the piecewise linear interpolating polynomial for the data and hence interpolate at $x = 0.5$ and 2.5	7	L3	CO1												
		<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>f(x)</td><td>1</td><td>2</td><td>5</td><td>10</td></tr></table>	x	0	1	2	3	f(x)	1	2	5	10					
x	0	1	2	3													
f(x)	1	2	5	10													
	c.	Evaluate $f(3)$ from the following table using Newton's divided interpolation formulae.	7	L3	CO1												
		<table><tr><td>x</td><td>0</td><td>1</td><td>4</td><td>8</td><td>10</td></tr><tr><td>f(x)</td><td>-5</td><td>-14</td><td>-125</td><td>-21</td><td>355</td></tr></table>	x	0	1	4	8	10	f(x)	-5	-14	-125	-21	355			
x	0	1	4	8	10												
f(x)	-5	-14	-125	-21	355												

OR

Q.6	a.	Apply appropriate interpolation formula to find $y(3)$.	6	L3	CO1														
		<table><tr><td>x</td><td>0</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr><tr><td>y</td><td>0</td><td>4</td><td>56</td><td>204</td><td>496</td><td>980</td></tr></table>	x	0	2	4	6	8	10	y	0	4	56	204	496	980			
x	0	2	4	6	8	10													
y	0	4	56	204	496	980													
	b.	Obtain the piecewise quadratic interpolating polynomial for the data and hence find $f(-0.5)$ and $f(2)$	7	L3	CO1														
		<table><tr><td>x</td><td>-2</td><td>0</td><td>1</td><td>3</td><td>4</td></tr><tr><td>f(x)</td><td>-23</td><td>1</td><td>4</td><td>82</td><td>193</td></tr></table>	x	-2	0	1	3	4	f(x)	-23	1	4	82	193					
x	-2	0	1	3	4														
f(x)	-23	1	4	82	193														
	c.	Find the Polynomial $f(x)$ using Lagrange's Interpolation formula given	7	L3	CO1														
		<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>5</td></tr><tr><td>f(x)</td><td>2</td><td>3</td><td>12</td><td>147</td></tr></table>	x	0	1	2	5	f(x)	2	3	12	147							
x	0	1	2	5															
f(x)	2	3	12	147															

Module – 4

Q.7	a.	Solve $\cos x (e^y + 1)dx + \sin x e^y dy = 0$.	6	L3	CO2
	b.	Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x - 1) + 3^x$	7	L3	CO2
	c.	Solve $(D^2 + 3D + 2)y = 1 + 3x + x^2$.	7	L3	CO2

OR

Q.8	a.	Solve $\frac{dy}{dx} + \frac{y}{x} = x^2 y^6$	6	L3	CO2
	b.	Solve $\left(3x^2 y + \frac{y}{x}\right)dx + (x^3 + \log_e x)dy = 0$	7	L3	CO2
	c.	Solve $(D^2 - 4)y = e^x + \cos 2x$.	7	L3	CO2

Module – 5

Q.9	a.	Using Simpson's one third rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates.	6	L3	CO2
	b.	Evaluate $y(1.4)$ by Milne's method, for the differential equation, $\frac{dy}{dx} = x^2(1+y)$ given that $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, and $y(1.3) = 1.979$.	7	L3	CO2
	c.	Find the solution of $\frac{dy}{dx} = x^2y - 1$, by Taylor's series method at $x = 0.2$ considering up to 4 th degree terms, given that $y(0) = 1$.	7	L3	CO2
OR					
Q.10	a.	Using Runge Kutta method of 4 th order solve $\frac{dy}{dx} = \frac{(y^2 - x^2)}{(y^2 + x^2)}$ with $y(0) = 1$ at $x = 0.2$.	6	L3	CO2
	b.	Applying Modified Euler's method, find $y(0.2)$ by solving the equation $\frac{dy}{dx} = x - y^2$, with $y(0) = 1$ taking $h = 0.1$	7	L3	CO2
	c.	Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ using Weddle's rule ($n = 6$)	7	L3	CO2
