

Model Question Paper-II with effect from 2025-26

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1BMATS201

Second Semester B.E./B.Tech. Degree Examination NUMERICAL METHODS: FOR CSE STREAM

TIME: 03Hours

Max.Marks:100

Note: 1. Answer any FIVE full questions, choosing at least ONE question from each MODULE.

2. VTU Formula Hand Book is Permitted

3. M: Marks, L: Bloom's level, C: Course outcomes.

Module-1		M	L	C		
Q 1.	a	Define the following i) Round off Error, ii) Inherent error, iii) Truncation error, iv) Absolute Error, v) Relative error, vi) Percentage error		6	L2	CO-1
	b	Obtain a second degree polynomial approximate to $f(x) = (1+x)^{\frac{1}{2}}$, $x \in [0, 0.1]$ using the Taylor series expansion about $x = 0$. Use the expansion to approximate $f(0.05)$ and find a bound of the truncation error.		7	L3	CO-1
	c	A real root of the equation $f(x) = x^3 - 5x + 1 = 0$ lies in the interval $(0,1)$. Perform four iterations of the Regular-Falsi method to obtain this root.		7	L3	CO-1
OR						
Q 2.	a	Find the absolute error if the number 0.00545828 is i) truncated to 3 decimal digits ii) round off to 3 decimal digits		6	L2	CO-1
	b	Find the root of the equation $x^3 - 4x - 9 = 0$, using the bisection method correct to three decimal places.		7	L3	CO-1
	c	Find the real root of the equation $3x = \cos x + 1$ by Newton Raphson method.		7	L3	CO-1
Module-2						
Q 3.	a	Find the condition number of an invertible matrix $A = \begin{bmatrix} 1 & 3 \\ 3 & 5 \end{bmatrix}$ with respect to L_1 norm.		6	L2	CO-1
	b	Apply LU decomposition to find the solution of the system of linear equations $3x + 2y + 7z = 4; 2x + 3y + z = 5; 3x + 4y + z = 7$.		7	L3	CO-1
	c	Using Rayleigh's power method, find the dominant eigen value and corresponding eigen vector for the matrix $\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ by choosing the initial vector $[1 \ 0 \ 0]^T$. Perform four iterations.		7	L3	CO-1
OR						
Q 4.	a	Show that following system of linear equation is ill conditioned. $2x + y = 4; 2x + 1.01y = 4$		6	L2	CO-1
	b	Use Gauss Seidel method to approximate the solution of system of linear equations $10x + 2y + z = 9; 2x + 20y - 2z = -44; -2x + 3y + 10z = 22$ near the point $(0,0,0)$. Perform three iterations.		7	L3	CO-1
	c	Using Jacobi's method find an approximate eigen values and eigen vectors of the matrix $\begin{bmatrix} 7 & 1 \\ 1 & 7 \end{bmatrix}$.		7	L3	CO-1

Module-3											
Q 5.	a	From the following table, estimate the number of students who obtained marks between 40 and 45.					6	L3	CO-1		
		Marks :	30 – 40	40 – 50	50 – 60	60 – 70				70 – 80	
		No. of Students:	31	42	51	35				31	
Q 5.	b	Find the piecewise quadratic interpolation polynomial for the function $f(x)$ defined for the data					7	L3	CO-1		
		x	-2	0	1	3				4	
		$f(x)$	-23	1	4	80				193	
		Hence interpolate at $x = -0.5$ and $x = 2$.									
Q 5.	c	Find the polynomial $f(x)$ by using Lagrange's formula and hence find $f(3)$ for					7	L3	CO-1		
		x :	0	1	2	5					
		$f(x)$:	2	3	12	147					
OR											
Q 6.	a	Estimate the value of $f(42)$ using appropriate interpolation formula from the following data.					6	L3	CO-1		
		x :	20	25	30	35				40	45
		$f(x)$:	354	332	291	260				231	204
Q 6.	b	Evaluate $f(9)$, using Newton's divide difference formula, from the data					7	L3	CO-1		
		x :	5	7	11	13				17	
		$f(x)$:	150	392	1452	2366				5202	
Q 6.	c	Using piecewise linear interpolation formula to find $f(3)$ and $f(1.5)$ from the data.					7	L3	CO-1		
		x :	1	2	4	8					
		$f(x)$:	3	7	21	73					
Module-4											
Q 7.	a	Solve $(y^4 + 2y)dx + (xy^3 + 2y^4 - 4x)dy = 0$					6	L3	CO-2		
	b	Solve $(D^4 + 4D^3 - 5D^2 - 36D - 36)y = 0$									
	c	Solve $(D^3 + 2D^2 + D)y = e^{-x} + \sin 2x$									
OR											
Q 8.	a	Solve $(x^3y^2 + xy)dx = dy$					6	L3	CO-2		
	b	Solve $\frac{d^4y}{dx^4} + 8\frac{d^2y}{dx^2} + 16y = 0$									
	c	Solve $(D^3 + 1)y = \cos(2x - 1) + 3^x$.									
Module-5											
Q 9.	a	Evaluate $\int_4^{5.2} \log x dx$ by 6 equal parts by Simpson's 1/3rd rule					6	L3	CO-2		
	b	Use Modified Euler's method to compute $y(1.2)$ correct to five decimal places given that $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$ and $y = 1$ at $x = 1$, taking $h = 0.1$.									
	c	Using Milne's method, compute y at $x=0.8$ from $\frac{dy}{dx} = x - y^2$ with the data $y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762$.									
OR											
Q 10.	a	Use Simpson's $3/8$ th rule to find $\int_0^{\pi/2} \sqrt{\cos x} dx$ by dividing $[0, \pi/2]$ into six equal parts.					6	L3	CO-2		
	b	Solve by Taylor's series method the equation $\frac{dy}{dx} = \log(xy)$ for $y(1.1)$ and $y(1.2)$ given $y(1)=2$.									
	c	Use forth order Runge-kutta method to solve $\frac{dy}{dx} = \frac{y-x}{(x+y)}, y(0) = 1$, at $x=0.1$ correct to four decimal places.									