22MAU624N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(Sixth Semester)

Branch – **MATHEMATICS**

NUMERICAL METHODS WITH R PROGRAMMING

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	In Gauss Elimination method, the coefficient matrix is reduced to (i) Diagonal form (ii) Lower triangular form (iii) Identity matrix (iv) Upper triangular form	K1	CO1
	2	The Gauss–Jacobi method is an example of _____. (i) Direct method (ii) Iterative method (iii) Exact method (iv) Graphical method	K2	CO1
2	3	Newton's forward difference formula is mainly used when the required value is near to _____. (i) End of the table (ii) MIddle of the Table (iii) Beginning of the table (iv) Ende of the Table	K1	CO2
	4	Simpson's one-third rule requires the number of subintervals to be (i) Odd (ii) Even (iii) Prime (iv) Zero	K2	CO2
3	5	The Taylor's series method for solving ODEs requires____. (i) Only first derivative (ii) No derivative (iii) Higher order derivatives (iv) Integration only	K1	CO3
	6	The Newton–Raphson method has_____. (i) Linear convergence (ii) Quadratic convergence (iii) No convergence (iv) Cubic convergence	K2	CO3
4	7	In R, the assignment operator is _____. (i) = (ii) <- (iii) == (iv) :=	K1	CO4
	8	A system of linear algebraic equations can be written in matrix form as _____. (i) AX = B (ii) A + X = B (iii) A − X = B (iv) A/B = X	K2	CO4
5	9	Which R function is used to perform numerical integration? (i) diff() (ii) integrate() (iii) deriv() (iv) quad()	K1	CO5
	10	The pracma package provides functions for _____. (i) Only integration (ii) Only differentiation (iii) Numerical mathematics routines (iv) Data frames	K2	CO5

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SECTION - B (35 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Describe the Gauss–Jordan Elimination Method and highlight the difference between Gauss Elimination and Gauss–Jordan methods.	K2	CO1
		(OR)		
	11.b.	Explain the algorithm for the Gauss–Seidel method and compare it with Gauss–Jacobi method.		
2	12.a.	Derive Newton's forward difference formula for the first derivative.	K1	CO2
		(OR)		
	12.b.	State and derive the Trapezoidal rule for numerical integration.		
3	13.a.	Using Taylor's series method, find y(0.1) correct to four decimal places, given dy/dx=x+y,y(0)=1.	K3	CO3
		(OR)		
	13.b.	Use the Bisection method to find a real root of x3−x−1=0 correct to three decimal places.		
4	14.a.	Explicate relational operators in R. Write an R program demonstrating Comparison of two numbers.	K4	CO4
		(OR)		
	14.b.	Find the zeros of the polynomial x4−5x2+4=0 using an appropriate numerical method.		
5	15.a.	Describe the use of the numDeriv package for computing gradients and Hessians.	K4	CO5
		(OR)		
	15.b.	Discuss the integrate() function in R with syntax and example.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions
ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Solve the following system of equations using Gauss Elimination Method. $2x + y - z = 82$ $-3x - y + 2z = -11$ $-2x + y + 2z = -3$	K2	CO1
2	17	Evaluate $\int_0^6 (x^3 + 1)\,dx$ using Simpson's One-Third Rule with h = 1.	K2	CO2
3	18	Using the fourth-order Runge–Kutta method, compute y(0.2) with step size h = 0.1, given dy/dx = x + y, y(0) = 1.	K3	CO3
4	19	Discuss the role of numerical methods in solving real-world problems. Explain how R tools assist in implementing numerical algorithms.	K4	CO4
5	20	Write an R program to compute numerical differentiation of a function using base R and compare it with analytical derivative.	K5	CO5

Z-Z-Z END