PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2025
(Sixth Semester)

Branch – **MATHEMATICS**

NUMERICAL METHODS WITH R PROGRAMMING

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1. The augmented matrix in Gauss Jordan method is reduced to ___.
   (i) Row Echelon form (ii) Column Echelon form
   (iii) Matrix Echelon form (iv) Augmented form

2. Trapezoidal formula is also known as ____.
   (i) Simpson's rule (ii) Co-ordinate method
   (iii) Prismoidal method (iv) Average end area method

3. What is the Order of convergence of Regula-Falsi method?
   (i) 2.312 (ii) 2.231
   (iii) 1.618 (iv) 1.321

4. Which operator is used to assign values in *R*?
   (i) ← (ii) =
   (iii) ⇒ (iv) :=

5. What is the matrix of second derivatives of a scalar function f with respect to coordinate components called?
   (i) Jacobian Matrix (ii) Hessian Matrix
   (iii) Covariance Matrix (iv) Correlation Matrix

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6. a) Solve the system of equations by Gauss elimination method.
   $x + 2y + z = 3,\quad 2x + 3y + 3z = 10,\quad 3x - y + 2z = 13.$
   OR
   b) Apply Gauss-Jordan method to find the solution of the following system:
   $10x + y + z = 12;\quad 2x + 10y + z = 13;\quad x + y + 5z = 7.$

7. a) Evaluate $\int_{-3}^{3} x^4 dx$ by using Trapezoidal rule.
   OR
   b) Evaluate $I = \int_0^6 \frac{1}{1+x} dx$ by using Simpson's one-third rule.

8. a) Compute y at $x = 0.25$ by Modified Euler method given $y' = 2xy$, $y(0) = 1$.
   OR
   b) Solve the equation $x^3 + x^2 - 1 = 0$ for the positive root by iteration method.

Cont...

9. a) Write a short note on relational operators in *R*.

OR

b) Write the coding for Newton-Raphson method.

10. a) Describe hessian matrix in *R*.

OR

b) Discuss integrating discretized functions in *R*.

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11. a) Solve the following system by Gauss-Jordan method:
$5x_1 + x_2 + x_3 + x_4 = 4;\ x_1 + 7x_2 + x_3 + x_4 = 12;$
$x_1 + x_2 + 6x_3 + x_4 = -5;\ x_1 + x_2 + x_3 + 4x_4 = -6.$

OR

b) Solve by Gauss-seidel method, the following system:
$28x + 4y - z = 32;\ x + 3y + 10z = 24;\ 2x + 17y + 4z = 35.$

12. a) Find the first two derivatives of $(x)^{1/3}$ at $x = 50$ and $x = 56$ given the table below:

x :	50	51	52	53	54	55	56
$y = x^{1/3}$:	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

OR

b) Find the value of $f'(0.5)$ using Stirling's formula from the following data:

x :	0.35	0.40	0.45	0.50	0.55	0.60	0.65
$y = f(x)$:	1.521	1.506	1.488	1.467	1.444	1.418	1.389

13. a) Solve $\frac{dy}{dx} = x + y$, given $y(1) = 0$, and get $y(1.1), y(1.2)$ by Taylor series method.

OR

b) Find the positive root of $x^3 - x = 1$ correct to four decimal places by bisection method.

14. a) Explain basic operators and functions in *R*.

OR

b) How to finding the zeros of a polynomial in *R*. Explain it.

15. a) Explain numerical differentiation using the *numDeriv* package in *R*.

OR

b) Explain basic integration in *R*.

Z-Z-Z END