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**Question Paper Code : 80612**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Fourth Semester

Civil Engineering

MA 6459 — NUMERICAL METHODS

(Common to Aeronautical Engineering, Electrical and Electronics Engineering, Instrumentation and Control Engineering, Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Geoinformatics Engineering, Petrochemical Engineering, Production Engineering, Chemical and Electrochemical Engineering, Textile Chemistry and Textile Technology)

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Derive a formula to find the value of  $\sqrt{N}$ , where  $N$  is a real number, by Newton's method.
2. Which of the iteration method for solving linear system of equation converges faster? Why?
3. Using Lagrange's interpolation formula find  $y$  value when  $x=1$  from the following data :

$x:$  0   -1   2   3

$y:$  -8   3   1   12

4. State Newton's forward formula and Backward formula.
5. Compare Trapezoidal rule and Simpson's 1/3 rule for evaluating numerical integration.
6. Change the limits of  $\int_0^{\pi/2} \sin x \, dx$  into  $(-1, 1)$ .



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7. Compare Single-step method and Multi-step method.
8. Write down the Milne's predictor and corrector formulas.
9. Classify the following equation  $u_{xx} + 4u_{xy} + 4u_{yy} - u_x + 2u_y = 0$ .
10. Write down the standard five point formula.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find a root of  $x \log_{10} x - 1.2 = 0$  using Newton Raphson method correct to three decimal places.
- (ii) Solve by Gauss Seidal method, the following system :  
 $20x + y - 2z = 17, 3x + 20y - z = -18, 2x - 3y + 20z = 25$ .

Or

- (b) (i) Find the dominant Eigen values of  $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$  using power method.
- (ii) Apply Gauss Jordan method, find the solution of the following system :  
 $2x - y + 3z = 8, -x + 2y + z = 4, 3x + y - 4z = 0$ .

12. (a) (i) Find an approximate polynomial for  $f(x)$  using Lagrange's interpolation for the following data :

$$\begin{array}{l} x: \quad \quad 0 \quad 1 \quad 2 \quad 5 \\ y = f(x): \quad 2 \quad 3 \quad 12 \quad 147 \end{array}$$

- (ii) Find the value of  $y$  at  $x = 21$  from the data given below :

$$\begin{array}{l} x: \quad \quad 20 \quad \quad 23 \quad \quad 26 \quad \quad 29 \\ y: \quad 0.3420 \quad 0.3907 \quad 0.4384 \quad 0.4848 \end{array}$$

Or

- (b) (i) Given the tables :

$$\begin{array}{l} x: \quad \quad 5 \quad \quad 7 \quad \quad 11 \quad \quad 13 \quad \quad 17 \\ y = f(x): \quad 150 \quad 392 \quad 1452 \quad 2366 \quad 5202 \end{array}$$

Evaluate  $f(9)$  using Newton's divided difference formula.







15. (a) (i) Using Bender Schmidt's method solve  $u_t = u_{xx}$  subject to the condition,  $u(0, t) = 0$ ,  $u(1, t) = 0$ ,  $u(x, 0) = \sin \pi x$ ,  $0 < x < 1$  and  $h = 0.2$ . Find the value of  $u$  up to  $t = 0.1$ .
- (ii) Evaluate the pivotal values of the equation  $u_{tt} = 16u_{xx}$  taking  $h = 1$  upto  $t = 1.25$ . The boundary conditions are  $u(0, t) = u(5, t) = u_t(x, 0) = 0$  and  $u(x, 0) = x^2(5 - x)$ .

Or

- (b) By Iteration method solve the elliptic equation  $u_{xx} + u_{yy} = 0$  over the square region of side 4, satisfying the boundary conditions  $u(0, y) = 0$ ,  $0 \leq y \leq 4$ ,  $u(4, y) = 12 + y$ ,  $0 \leq y \leq 4$ ,  $u(x, 0) = 3x$ ,  $0 \leq x \leq 4$ ,  $u(x, 4) = x^2$ ,  $0 \leq x \leq 4$ . By dividing the square into 16 square meshes of side 1 and always correcting the computed values to two places to decimals. Obtain the values of  $u$  at 9 interior pivotal points.