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Question Paper Code: 54002

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fourth Semester

Civil Engineering

15UMA422 - NUMERICAL METHODS

(Common to Electrical and Electronics Engineering,
Electronics and Instrumentation Engineering and Chemical Engineering)

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. What is the order of convergence of iteration method?
(a) 4 (b) 3 (c) 2 (d) 1
2. To what form the coefficient matrix is transformed in Gauss elimination method?
(a) Diagonal (b) Idempotent (c) Singular (d) Symmetric
3. The n^{th} divided differences of a polynomial of the n^{th} degree are
(a) n (b) constant (c) $n + 1$ (d) $n^2 + 1$
4. Newton's forward interpolation formula used only for _____ intervals.
(a) finite (b) infinite (c) equal (d) unequal
5. What is the order of error in Trapezoidal formula?
(a) h^2 (b) h^3 (c) h^4 (d) h^5
6. Apply Gaussian two-point formula, the value of $\int_{-1}^1 \frac{dx}{1+x^2} =$
(a) 3.0 (b) 2.5 (c) 2.0 (d) 1.5

7. Find $y(0.1)$ if $y' = 1 + y$, $y(0) = 1$, by using Euler's method.
 (a) 0.9231 (b) 1.2013 (c) 1.3012 (d) 0.0001
8. The Predictor-Corrector methods are _____ starting methods.
 (a) independent (b) multi self (c) not self (d) self
9. The second order linear partial differential equation is elliptic if
 (a) $b^2 - 4ac < 0$ (b) $b^2 - 4ac = 0$ (c) $b^2 - 4ac > 0$ (d) $b^2 - 4ac \leq 0$
10. In solving equation $u_t = \alpha^2 u_{xx}$ by Crank-Nicholson method to simplify method we take $\frac{(\Delta x)^2}{\alpha^2 k}$ as
 (a) 0 (b) $\frac{1}{2}$ (c) 1 (d) 2

PART - B (5 x 2 = 10 Marks)

11. Solve the system of equations $x - 2y = 0$, $2x + y = 5$ by Gauss Elimination method.
12. State Newton's backward Interpolation formula.
13. State the Simpson's 3/8 rule to find the value of $I = \int f(x) dx$.
14. Given $y' = x + y$, $y(0) = 1$, find $y(0.1)$ by Euler's modified method.
15. Write down the Leibmann iteration formula.

PART - C (5 x 16 = 80 Marks)

16. (a) Find the numerically largest eigen value of $A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ by power method. (16)

Or

- (b) Find the inverse of the given matrix by Gauss-Jordan method $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 1 \end{bmatrix}$. (16)

17. (a) Find $y(40)$ from the following data using Lagrange's interpolation formula given that $y(2) = 18$, $y(5) = 180$, $y(7) = 448$, $y(10) = 1210$, $y(12) = 2028$. (16)

Or

- (b) (i) Find $f(3)$ by Newton's divided difference formula for the data: (16)

x:	0	1	2	4	5
f(x):	1	14	15	5	6

18. (a) (i) Evaluate $\int_0^{\pi} \sin x \, dx$ by Trapezoidal rule, Simpson's 1/3 rule with $n = 10$. (8)

(ii) Evaluate $\int_1^2 \int_1^2 \frac{dxdy}{x+y}$, using simpsons 1/3 rule, taking $\Delta x = \Delta y = 0.25$. (8)

Or

(b) (i) Evaluate $\int_0^1 \frac{dx}{\sqrt{1+x^4}}$, using three point Gaussian formula. (8)

(ii) Evaluate: $\int_1^2 \int_1^2 \frac{dxdy}{x^2+y^2}$ using Trapezoidal rule by taking $h=0.2$ and $k=0.25$. (8)

19. (a) Using R-K method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2$ and $x = 0.4$. (16)

Or

(b) Determine the value of $y(0.4)$ using Milne's method given $y' = xy + y$, $y(0) = 1$; use Taylor series to get the values of $y(0.1)$, $y(0.2)$, $y(0.3)$. (16)

20. (a) Solve $u_{xx} + u_{yy} = -10(x^2 + y^2 + 10)$ over the square with sides $x = 0$, $y = 0$, $x = 3$, $y = 3$ with $u = 0$ on the boundary, taking $h = 1$. (16)

Or

(b) Solve the Poisson's equation $\Delta^2 u = 10(x^2 + y^2 + 10)$ over the square mesh with sides $x=0$, $y=0$, $x=3$, $y=3$ with $u=0$ on the boundary and mesh length 1 unit. (16)

