Reg. No. : | | | | | | | | | | | |

H 2425

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Fourth/Fifth/Sixth Semester

MA 038 — NUMERICAL METHODS

(Common to all branches)

(Except : Electrical and Electronics Engineering, Electronics and Communication Engineering, Marine Engineering, Bio-Medical Engineering, Information Technology, Fashion Technology and Biotechnology)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the order of convergence of the Newton-Raphson method?

2. Solve $3x - y = 2, x + 3y = 4$ using Gaussian elimination method.

3. Derive the Newton's forward difference formula.

4. Write down the Stirling's central difference formula.

5. Use trapezoidal rule to evaluate $\int_0^1 x^3 dx$ considering the intervals.

6. Using 2-point Gaussian quadrature, evaluate $\int_0^1 \frac{dx}{1+x}$.

7. Using Taylor series method, solve $\frac{dy}{dx} = x^2 y - 1$, $y(0) = 1$ considering term upto x^2, and compute y at $x = 0.1$.

8. Define single step and multistep methods.

9. Write down the finite difference scheme of the differential equation $y'' = x + y$, $y(a) = y_0$.

10. Write down the finite difference scheme for the solution of the one dimensional wave equation.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Find by Newton-Raphson method, the real root of the equation $3x = \cos x + 1$. (8)

(ii) Apply Gauss-Seidal method, to solve $2x + y + 6z = 9$, $8x + 3y + 2z = 13$, $x + 5y + z = 7$. (8)

Or

(b) (i) Apply Gauss-Jordon method to solve the equation $x + y + z = 9$, $2x - 3y + 4z = 13$, $3x + 4y + 5z = 40$. (8)

(ii) Using power method, find the largest value in magnitude of the matrix

$$\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}.$$ (8)

12. (a) (i) Using Newton's forward formula, find the value of $f(1,6)$ if (8)

x :	1	1.4	1.8	2.2
$f(x)$:	3.49	4.82	5.96	6.5

(ii) Use Lagrange's interpolation formula to find the value of y then $x = 10$, if the following values of x and y are given : (8)

x :	5	6	9	11
y :	12	13	14	16

Or

(b) (i) Employ Bessel's formula to find the value of F at $x = 1.95$, given that : (8)

x :	1.7	1.8	1.9	2.0	2.1	2.2	2.3
F :	2.979	3.144	3.283	3.391	3.463	3.997	4.491

(ii) Apply Newton's Backward difference formula to find the value of y at $x = 410$, from the following data : (8)

x = height :	100	150	200	250	300	350	400
y = distance :	10.63	13.03	15.04	16.81	18.42	19.90	21.27

13. (a) (i) Evaluate : $\int_0^1 \frac{dx}{1+x^2}$ using trapezoidal rule and Simpson's 1/3 rule with 8-sub intervals. (8)

(ii) For the following values of x and y, find the first derivative at $x = 4$. (8)

x :	1	2	4	8	10
y :	0	1	5	21	27

Or

(b) (i) Find $y'(0)$ and $y''(0)$ from the following data : (8)

x :	0	1	2	3	4	5
y :	4	8	15	7	6	2

(ii) Using 3-point Gaussian quadrature, evaluate $\int_{-2}^{2} e^{\frac{-x}{2}} dx$. (8)

14. (a) (i) Apply Runge-Kutta fourth order method to find an approximate value of y when $x = 0.2$. Given that $\frac{dy}{dx} = x + y$ and $y(0) = 1$. (8)

(ii) Given $\frac{dy}{dx} = x^2(1+y)$ and $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$, evaluate $y(1.4)$ by Adam's-Bashforth method. (8)

Or

(b) Solve $\frac{dy}{dx} = x + y^2$, $y(0) = 1$,

(i) By modified Euler method at $x = 0.1$ and $x = 0.2$

(ii) By 4^{th} order R – K method at $x = 0.3$

(iii) By Milne's predictor-corrector method at $x = 0.4$. (16)

15. (a) Find the values of $u(x,t)$ satisfying the parabolic equation $\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$ and the boundary condition $u(0,t) = 0 = u(\delta,t)$ and $u(x,0) = 4x - \frac{x^2}{2}$, with $h = 1$ and $k = \frac{1}{8}$ for 3 time steps. (16)

Or

(b) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = (x^2 + y^2)e^{xy}$, $0 < x < 1$, $0 < y < 1$, $u(0,y) = 1$, $u(1,y) = e^y$, $0 \le y \le 1$, $u(x,0) = 1$, $u(x,1) = e^x$, $0 \le x \le 1$, with $h = k = \frac{1}{3}$. (16)

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