25/10/17

Registration Number | | | | | | | | | |

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B.E./B.Tech (Full Time) Arrear Examinations - Nov/Dec 2013
SEMESTER 4-(REGULATIONS:2002/2004/2008)

(Common to Agriculture/Mechanical/EEE)

MA038/MA502/MA9262 NUMERICAL METHODS

Max Marks: 100 **ANSWER ALL QUESTIONS** **Time: 3 Hours**

PART A (10 × 2 = 20 Marks)

1. State the order of convergence and convergence condition for Newton's Raphson method.
2. Explain briefly the principle used in Gauss-Jordan method.
3. Define a cubic spline.
4. When to use Newton's forward and backward difference interpolation formulae?
5. Using three point Gaussian formula, find $\int_{0.2}^{1.5} e^{-t^2} dt$.
6. What is the order of error in Trapezoidal rule and Simpson's $3/8^{th}$ rule?
7. Compare single step and multi-step methods.
8. What are the values of k_1, and l_1 to solve the equation $y'' + xy' + y = 0$, y(0)=1, $y'(0) = 0$ by R-K method of fourth order.
9. Write down the finite difference scheme for solving $y'' + x + y = 0, y(0) = 0 = y(1)$.
10. State the condition for the stability of the solution of one dimensional heat equation obtained by explicit method in terms of mesh ratio parameters.

PART B (5 × 16 = 80 Marks)

11. (a) i. Given the values

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

evaluate $f(9)$, using Lagrange's formula. (8)

ii. Using a suitable interpolation formula find the value of $f(0.47)$ for the data:

x	0	0.1	0.2	0.3	0.4	0.5
$f(x)$	1	1.1103	1.2428	1.3997	1.5836	1.7974

(8)

12. (a) i. Using iterative method, find the root of $x^3 + 4x^2 - 10 = 0$ in $[1, 2]$. (8)

ii. Solve the following system of equations by Gauss-Seidel method: $28x + 4y - z = 32$; $x + 3y + 10z = 24$ and $2x + 17y + 4z = 35$. (8)

(OR)

(b) i. Find the inverse of $\begin{pmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{pmatrix}$ using Gauss-Jordan method. (8)

ii. Using Jacobi's method, find all the eigen values and the eigen vectors of the matrix $\begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$. (8)

13. (a) i. Find the first two derivatives of $x^{1/3}$ at $x = 56$ 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

(8)

ii. Evaluate $\int_0^2 \frac{1}{x^2 + x + 1} dx$ dividing the range of integration into 4 equal parts using Simpson's $\frac{1}{3}$ rule. (8)

(OR)

(b) i. Use Romberg's method to compute $\int_0^1 \frac{dx}{1 + x^2}$ correct to 4 decimal places. (8)

ii. Using trapezoidal rule evaluate $\int_{1.4}^{2.0} \int_{1.0}^{1.5} ln(x+2y) dy dx$, taking $\triangle x = 0.15$ and $\triangle y = 0.25$. (8)

14. (a) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given that $y(0) = 1$ at $x = 0.2$ and $x = 0.4$. (16)

(Or)

(b) Given $y' = x(x^2 + y^2)e^{-x}$, $y(0) = 1$ find y at $x = 0.1$, 0.2 and 0.3 by Taylor's series method and compute $y(0.4)$ by Milne's method. (16)

15. (a) i. Evaluate the pivotal values of the equation $u_{tt} = 16u_{xx}$, taking $h = 1$ and $k = 0.25$ upto $t = 1.25$. The boundary conditions are $u(0, t) = u(5, t) = 0$, $u_t(x, 0) = 0$ and $u(x, 0) = x^2(5 - x)$. (8)

ii. Using explicit formula, solve $u_t = u_{xx}$ in $0 < x < 5$, $t > 0$ given that $u(0, t) = 0$, $u(5, t) = 0$, $u(x, 0) = x^2(25 - x^2)$. Compute $u(x, t)$ up to $t = 5$ with $h = 1$. (8)

(OR)

(b) i. Solve the Laplace's equation over the square mesh of side 4 units, satisfying the boundary conditions: $u(0,y) = 0,\ u(4,y) = 12 + y,\ 0 \leq y \leq 4$ and $u(x,0) = 3x,\ u(x,4) = x^2,\ 0 \leq x \leq 4$. (16)

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