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

Question Paper Code : 23532

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Fourth Semester

Civil Engineering

MA 1251/070030010/070030020/070030021/070230054 — NUMERICAL METHODS

(Common to Metallurgical Engineering/Petroleum Engineering/Mechatronics Engineering/Aeronautical Engineering and Electrical and Electronics Engineering)

(Common to Sixth Semester, Mechanical Engineering, Computer Science and Engineering, Information Technology, Chemical Engineering and Automobile Engineering)

(Common to Fifth Semester Food Technology and Electronics and Communication Engineering)

(Common to MA 1011 Numerical Methods for Sixth Semester Electronics and Communication Engineering)

(Regulation 2004/2007)

(Common to B.E. (Part-Time) – Third Semester – Civil Engineering and Fourth Semester, Mechanical Engineering, Regulations 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. How to reduce the number of iterations while finding the root of an equation by Regula-Falsi method?

2. State the condition for convergence of Gauss-Seidel method.

3. Give the Newton's divided difference interpolation formula.

4. When is Newton's backward interpolation formula used?

5. Write the difference table for

x	:	3	5	7	9
y	:	6	24	58	108

6. State Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rules of numerical integration.

7. Given $y' = x + y, y(0) = 1$, find $y(0.1)$ by Taylor series.

8. How many prior values are required to predict the next value in Adam's method?

9. Give the Crank-Nicolson difference scheme formula to solve the equation $u_t = a^2 u_{xx}$.

10. Write down the standard five point formula to solve the Laplace equation $\nabla^2 U = 0$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Using Newton-Raphson method, find a root of the equation $x^3 - 5x + 3 = 0$ correct to three decimal places.

(ii) Solve the system of equations $2x + y + z = 12$, $3x + 2y + 3z = 24$, $x + 4y + 9z = 34$ by gauss-Jordan method.

Or

(b) (i) Find the inverse of the matrix $\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$ by Gauss-Jordan method.

(ii) Using power method find the eigen value of the matrix $\begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$.

12. (a) (i) Given the values $f(14) = 68.7$, $f(17) = 64$, $f(31) = 44$ and $f(35) = 39.1$, find $f(27)$ using Lagrange's formula.

(ii) Using Newton's backward interpolation formula, find the polynomial of degree four passing through (1, 1), (2, –1), (3, 1), (4, –1) and (5, 1).

Or

(b) (i) Fit a polynomial of third degree to the following data using Newton's divided difference method.

x	:	0	1	2	4	5	6
$f(x)$	:	1	14	15	5	6	9

(ii) Using Newton's forward interpolation formula find the value of $f(1.6)$ if

x	:	1	1.4	1.8	2.2
$f(x)$	:	3.49	4.82	[illegible]	[illegible]

13. (a) (i) Find $y'(0)$ and $y''(0)$ from the following table:

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

(ii) Compute the value of Π by evaluating $\int_0^1 \frac{dx}{1+x^2}$, using Simpson's $\frac{1}{3}$ rule with 10 divisions.

Or

(b) (i) Apply Simpson's $\frac{3}{8}$ rule to evaluate $\int_0^2 \frac{dx}{1+x^3}$ to two decimal places by dividing the range into eight equal parts.

(ii) Evaluate $\int_0^1 \frac{dx}{1+x}$ correct to three decimal places by Trapezoidal rule with h =- 0.5, 0.25 and 0.125. Use Romberg's method to get an accurate value for the definite integral. Hence find the value of $\log_e 2$.

14. (a) (i) Using Taylor's series method solve $y' = xy + y^2, y(0) = 1$ at $x = 0.1, 0.2, 0.3$.

(ii) Using Adam's predictor-corrector method, find $y(1.4)$ given that $x^2y' + xy = 1; y(1) = 1, y(1.1) = 0.996, y(1.2) = 0.986, y(1.3) = 0.972$.

Or

(b) (i) Using Runge-Kutta fourth order method, find $y(0.1)$ and $y(0.2)$ given that $\frac{dy}{dx} - y = -x; y(0) = 2$.

(ii) Given $y' + y = 1, y(0) = 0$, find $y(0.1)$ by using Euler's method, $y(0.2)$ and $y(0.3)$ by Improved Euler's method, and $y(0.4)$ by Milne's method.

15. (a) Solve by Crank-Nicolson's method $\frac{\partial u}{\partial t} = \frac{1}{16}\frac{\partial^2 u}{\partial x^2}, 0 < x < 1, t > 0, u(x,0) = 0$, $u(0,t) = 0, u(1,t) = 100t$. Compute u for one step with $h = \frac{1}{4}$.

Or

(b) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to

(i) $u(0, y) = 0 \; for \; 0 \leq y \leq 4$

(ii) $u(4, y) = 12 + y, for \; 0 \leq y \leq 4$

(iii) $u(x, 0) = 3x, for \; 0 \leq x \leq 4$

(iv) $u(x, 4) = x^2, for \; 0 \leq x \leq 4$

by dividing the square into 16 square meshes of side 1.
