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

Question Paper Code : P 1382

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fourth Semester

(Regulation 2004)

Civil Engineering

MA 1251 — NUMERICAL METHODS

(Common to Aeronautical Engineering, Electrical and Electronics Engineering, Mechantronics Engineering, Metallurgical Engineering and Petroleum Engineering)

(Common to B.E. (Part-Time) Third Semester Civil Engineering, Computer Science and Engineering and Mechanical Engineering Regulation 2005)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of false position correct to one decimal place.

2. State the Newton's formula and order of convergence of that method.

3. Write the Newton's backward difference interpolation formula.

4. Evaluate $\left(\frac{\Delta^2}{E}\right)e^x \cdot \frac{Ee^x}{\Delta^2 e^x}$.

5. State Newton's forward difference formula to find $\left(\frac{dy}{dx}\right)_{x=x_0}$ and $\left(\frac{d^2y}{dx^2}\right)_{x=x_0}$.

6. Write the Simpson's 1/3rd and 3/8th formulae.

7. Write Adam's P-C formula for solving IVP.

8. Find $y\,(0.2)$ when $y' = -2xy^2$, $y\,(0) = 1$ and $h = 0.2$, by Euler's method.

9. Write the finite difference scheme for the second order differential equat
$y'' = f$, $h = 1/n$.

10. State the explicit finite difference scheme for one dimensional wave equati
$\frac{\partial^2 u}{\partial t^2} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find a real root of the equation $x \log_{10} x = 1.2$ by regula-fal method correct to four decimals. (4

(ii) Find by Newton's method, the real root of the equatio $3x = \cos x + 1$. (4

(iii) Solve the equation

$10x - 7y + 3z + 5u = 6$,

$-6x + 8y - z - 4u = 5$,

$3x + y + 4z + 11u = 2$,

$5x - 9y - 2z + 4u = 7$, by Gauss Jordan method. (8)

Or

(b) (i) Solve by Gauss-Seidal iteration method

$20x + y - 2z = 17;\ 3x + 20y - z = -18;\ 2x - 3y + 20z = 25$. (8)

(ii) Determine the largest Eigenvalue and the corresponding Eigenvector of the matrix using the power method : (8)

$$A = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}.$$

12. (a) (i) Given the values

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

Evaluate $f(9)$, using (1) Lagrange's formula (2) Newton's divided difference formula. (10)

(ii) The following are data from the steam table :

Temp. °C :	140	150	160	170	180
Pressure kg f/cm^2 :	3.685	4.854	6.302	8.076	10.225

Using Newton's formula. Find the pressure of the steam for a temperature 142°C. (6)

Or

(b) (i) Calculate the nth divided difference of $f(x) = 1/x$. (8)

(ii) From the given table compute the value of $\sin 38°$. (8)

x :	0°	10°	20°	30°	40°
$\sin x$:	0	0.17365	0.34202	0.50000	0.64279

13. (a) (i) Determine $y(x)$ as a polynomial in x for the following data, using Newton's divided difference formula. Given that

x :	1.0	1.1	1.2	1.3	1.4	1.5	1.6
$y(x)$:	7.989	8.403	8.781	9.129	9.451	9.45	10.031

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$ and at $x = 1.6$. (8)

(ii) Evaluate $\int_0^6 \frac{1}{1+x^2}dx$ by Trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule and compare the result with its actual value. (8)

Or

(b) (i) Compute by Gaussian quadrature $I = \int_0^1 \frac{\log(x+1)}{\sqrt{x(1-x)}}dx$. The error must not exceed 5×10^{-5} also obtain an error bound. (8)

(ii) Evaluate the double integral $\int_0^1 \left\{ \int_1^2 \frac{2xy}{(1+x^2)(1+y^2)} dy \right\} dx$. Using the trapezoidal rule with $h = k = 0.25$. The Simpson's rule with $h = k = 0.25$. Compare the results obtained with the exact solution. (8)

14. (a) (i) Using Taylor Series method, compute the value $y(0.1)$, $y(0.2)$, $y(0.3)$ and $y(0.4)$ correct to three decimal p from $\frac{dy}{dx} = 1 - 2xy$ given that $y(0) = 0$.

(ii) Using modified Euler's method find y at $x = 0.1$ and $x = 0.2$ gi $\frac{dy}{dx} = y - 2x/y$, $y(0) = 1$.

Or

(b) (i) The differential equation $\frac{dy}{dx} = y - x^2$ is satisfied by $y(0) =$ compute the value of $y(0.8)$ by Milne's predictor-corrector formu (

(ii) Solve $\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 + y^2 = 0$ using Runge-Kutta method fo $x = 0.2$. Correct to 4 decimal places. Given that $y(0) = 1$, $y'(0) = 0$ (8

15. (a) Solve $U_{xx} + U_{yy} = 0$ in $0 \le x \le 4, 0 \le y \le 4$. Given that $u(0, y) = 0$; $u(4, y) = 8 + 2y$; $u(x, 0) = x^2/2$ and $u(x, 4) = 2$ taking $h = k = 1$. Obtain the result correct to one decimal. (16)

Or

(b) Solve the Poisson's equation $\nabla^2 u = 8x^2y^2$ for the square mesh of the given figure with $u(x, y) = 0$ on the boundary and mesh length $= 1$. (16)