Reg. No. : [| | | | | | | | | | |]

Question Paper Code : 21776

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Sixth Semester

Computer Science and Engineering

MA 2264/MA 41/MA 51/MA 1251/080280026/10177 MA 401/10144 CSE 21/
10144 ECE 15 – NUMERICAL METHODS

(Common to Sixth Semester – Electronics and Communication Engineering Industrial Engineering and Information Technology, Fifth Semester – Polymer Technology, Chemical Engineering and Polymer Technology, Fourth Semester – Aeronautical Engineering, Civil Engineering, Electrical and Electronics Engineering and Mechatronics Engineering)

(Regulations 2008/2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Derive Newton's algorithm for finding the p^{th} root of a number N, where $N > 0$.

2. Explain the procedure involved in the Gauss Jordan elimination method.

3. Show that $\underset{bcd}{\overset{3}{\Delta}} \left(\frac{1}{a}\right) = -\frac{1}{abcd}$.

4. Derive Newton's forward difference formula by using operator method.

5. State two point Gaussian quadrature formula.

6. Evaluate $\int_{\frac{1}{2}}^{1} \frac{1}{x} dx$ by Trapezoidal rule, dividing the range into 4 equal parts.

7. State the disadvantages of Taylor series method.

8. Using Euler's method find $y(0.1)$, given $\frac{dy}{dx} = x + y$, $y(0) = 1$.

9. Write the finite difference approximations for $y'(x)$, $y''(x)$.

10. Write the Crank-Nicholson scheme to solve $u_t = \alpha^2 u_{xx}$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Solve $e^x - 3x = 0$ by the method of fixed point iteration. (8)

(ii) Solve the following system by Gauss-Seidal iterative procedure : $10x - 5y - 2z = 3, 4x - 10y + 3z = -3, x + 6y + 10z = -3$. (8)

Or

(b) (i) Using Gauss-Jordan method, find the inverse of $\begin{bmatrix} 2 & 2 & 6 \\ 2 & 6 & -6 \\ 4 & -8 & -8 \end{bmatrix}$. (8)

(ii) Using power method, find all the eigenvalues of $A = \begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$. (8)

12. (a) (i) Find the Lagrange polynomial $f(x)$ satisfying the following data :

x	1	3	5	7
$y = f(x)$	24	120	336	720

and hence find $f(4)$. (8)

(ii) From the following table :

x	1	2	3
y	–8	–1	18

Compute $y(1.5)$ and $y'(1)$, using cubic spline. (8)

Or

(b) (i) Using Newton's divided difference formula determine $f(3)$ from the data : (8)

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

(ii) From the following data, find θ at $x = 43$ and $x = 84$.

x :	40	50	60	70	80	90
θ :	184	204	226	250	276	304

Also express θ interms of x. (8)

13. (a) (i) Find $f'(3)$ and $f''(3)$ for the following data : (8)

x	3.0	3.2	3.4	3.6	3.8	4.0
$f(x)$	–14	–10.032	–5.296	–.256	6.672	14

(ii) Evaluate $\int_1^2\int_3^4 \frac{1}{(x+y)^2}\,dx\,dy$ taking $h = k = 0.5$ by both Trapezoidal rule and Simpson's rule. (8)

Or

(b) (i) Evaluate $\int_0^2 \frac{x^2+2x+1}{1+(x+1)^4}\,dx$ by Gaussian three point formula. (8)

(ii) Using Romberg's method, evaluate $I = \int_0^1 \frac{dx}{1+x}$ correct to three decimal places and hence evaluate the value of $\log_e^2$. (8)

14. (a) (i) Using Taylor series method solve $\frac{dy}{dx} = 1 + xy$ with $y(0) = 2$. Find $y(0.1)$, $y(0.2)$ and $y(0.3)$. (8)

(ii) Using Milne's method find $y(4.4)$ given $5xy' + y^2 - 2 = 0$, given $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$ and $y(4.3) = 1.0143$. (8)

Or

(b) (i) Find $y(0.8)$ given that $y' = y - x^2$, $y(0.6) = 1.7379$ by using Runge-Kutta method of order four. Take $h = 0.1$. (8)

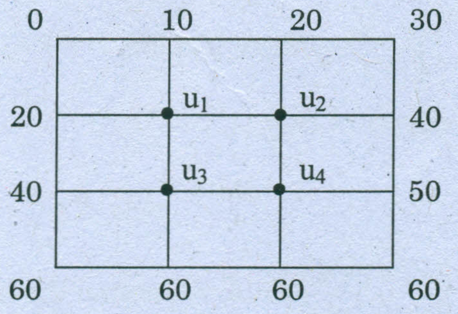
(ii) Given $\frac{dy}{dx} = x^2(1+y)$, $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$, evaluate $y(1.4)$ by Adams-Bashforth method. (8)

15. (a) (i) Solve $y'' - y = 0$ with $y(0) = 0, y(1) = 1$ using finite difference method with $h = .2$. (8)

(ii) Solve numerically $4u_{xx} = u_{tt}$ with the boundary conditions $u(0,t) = 0 = u(4,t)$ and the initial conditions $u_t(x,0) = 0$ and $u(x,0) = x(4-x)$, taking $h = 1$, for 4 time steps. (8)

Or

(b) (i) Solve $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ at the nodal points of the following square grid using the boundary values indicated. (8)



(ii) Find the values of the function $u(x,t)$ satisfying the differential equation $u_t = 4u_{xx}$ and the boundary condition $u(0,t)=0=u(8,t)$ and $u(x,0)=4x-\frac{x^2}{2}$ at the point $x=i$, $x=0,1,2,3,4,5,6,7,8, t=\frac{1}{8}j$, $j=0,1,2,3,4,5$. (8)