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08MTP/CFD/AUE11

First Semester M.Tech. Degree Examination, Dec 08 / Jan 09

Applied Mathematics

Time: 3 hrs. Max. Marks:100

Note : *Answer any FIVE full questions.*

1 a. Write a note on the types of errors involved in numerical calculations. **(06 Marks)**

b. Define and explain i) ill – conditioned ii) well conditioned systems of linear equations with simple examples. **(08 Marks)**

c. Test for consistency and solve $2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$ by Gauss – elimination method. **(06 Marks)**

2 a. Solve the system of equations $2x + 3y + z = 9$, $x + 2y + 3z = 6$, $3x + y + 2z = 8$. Using LU – Decomposition method. **(08 Marks)**

b. Solve the system of equations $2x_1 - x_2 + 0x_3 = 7$, $-x_1 + 2x_2 - x_3 = 1$, $0x_1 - x_2 + 2x_3 = 1$, using Gauss – Seidal method and also by its error format. **(12 Marks)**

3 a. Using Givens method, reduce the matrix

$$A = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 4 & 2 \\ 3 & 2 & 3 \end{bmatrix}$$ to tri – diagonal form. **(07 Marks)**

b. Determine the largest Eigen value and the corresponding Eigen vector of the matrix

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$ by assuming initial Eigen vector as $\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ using power method. **(07 Marks)**

c. Define i) Vector norm ii) Matrix Norm and also give the properties of each Norms. **(06 Marks)**

4 a. Given that

x:	1	1.1	1.2	1.3	1.4	1.5
y:	7.989	8.403	8.781	9.129	9.451	9.750

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$ **(06 Marks)**

b. If 'u' is a function of x and y, find the finite difference approximations to the partial derivatives , $\frac{\partial u}{\partial x}, \frac{\partial u^2}{\partial x^2}, \frac{\partial u}{\partial y}, \frac{\partial u^2}{\partial y^2}$. **(08 Marks)**

c. Solve the boundary value problem $y'' + y + 1 = 0$ given $y(0) = 0$ and $y(1) = 0$ using finite difference method. **(06 Marks)**

5 a. Compute $\int_0^1 \frac{dx}{1+x^2}$ correct to '4'decimal places, using Rombergs method. **(08 Marks)**

b. Evaluate $\int_2^{2.6} \int_4^{4.4} \frac{dx\ dy}{x\ y}$ using Simpson's rule. **(06 Marks)**

c. Find the area from the table given below, which is founded by the curve y = f(x), x – axis and the ordinates x = 7.47 and x = 7.52. Using Trapezoidal rule. **(06 Marks)**

x :	7.47	7.48	7.49	7.50	7.51	7.52
y = f(x):	1.93	1.95	1.98	2.01	2.03	2.06

6 a. Use Euler's method to solve numerically the initial value problem $u^1 = -2t\,u^2$, $u(0) = 1$ with $h = 0.2$. **(08 Marks)**

b. Solve the system of equations for u(0.2) and v(0.2)
$u^1 = -3u + 2v, \quad u(0) = 0$ **(12 Marks)**
$v^1 = 3u - 4v, \quad v(0) = 0.5$. (Take h = 0.2) Using Runga – Kutta fourth order method.

7 a. Given $\frac{dy}{dx} = 1 + y^2$ with the table

x :	0	0.2	0.4	0.6
y:	0	0.2027	0.4228	0.6841

Find y(0.8) using Adams – Predictor and corrector formula. **(08 Marks)**

b. Using shooting method, solve the first boundary value problem
with $u'' = u + 1, \quad 0 < x < 1$
$u(0) = 0, \quad u(1) = e-1$. **(12 Marks)**

8 a. Obtain the solution of the heat equation

$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x, 0) = 0$. $u(0, t) = 0$, $u(l, t) = t$.

taking $k = \frac{1}{8}$ and h $1/2$. Using Crank – Nicolson formula. **(12 Marks)**

b. Solve numerically $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions

$$\left.\begin{array}{l} u(0, t) = 0 \\ u(1, t) = 0 \end{array}\right\} \quad (t > 0)$$

$$\left.\begin{array}{l} \frac{\partial u}{\partial t}(x,0) = 0 \\ u(x, 0) = \sin^3(\pi x) \end{array}\right\} \quad \text{for } 0 < x < 1.$$

(Take h = 0.25 k ≥ 0.2 use explicit formula). **(08 Marks)**

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