USN | | | | | | | | | |

10MTP11

First Semester M.Tech. Degree Examination, December 2012
Applied Mathematics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Convert $(58)_{10}$ to the corresponding binary number. **(06 Marks)**

b. Find the solution of the system of equations using Cramer's rule.
$x_1 + 2x_2 - x_3 = 2,\ 3x_1 + 6x_2 + x_3 = 1,\ 3x_1 + 3x_2 + 2x_3 = 3.$ **(07 Marks)**

c. Solve the system of equations:
$10x_1 - x_2 + 2x_3 = 4$
$x_1 + 10x_2 - x_3 = 3$
$2x_1 + 3x_2 + 20x_3 = 7$ using Gauss elimination method. **(07 Marks)**

2 a. Find the inverse of the matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ 4 & 3 & -1 \\ 3 & 2 & 2 \end{bmatrix}$ using Gauss Jordan elimination method. **(10 Marks)**

b. Find the solution of the following set of complex equations:
$$\begin{bmatrix} 2+i & 1-4i \\ 4+2i & 5+3i \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 3+2i \\ 2-2i \end{bmatrix}$$ **(10 Marks)**

3 a. Using the Jacobi method find all the eigen values and eigen vectors of the matrix.
$$A = \begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$$ **(10 Marks)**

b. Find the numerically largest eigen value and the corresponding eigen vector of the matrix
$$A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$$
using power method taking initial vectors as $[1,\ 0,\ 0]^T$. **(10 Marks)**

4 a. Given :

x	1	1.2	1.4	1.6	1.8	2.0
y	2.72	3.32	4.06	4.96	6.05	7.39

find y^{I} and y^{II} at x = 1.2. **(10 Marks)**

b. If f is a function of x and y, find the finite difference approximations to the partial derivatives $\frac{\partial^2 f}{\partial x^2}$, $\frac{\partial^2 f}{\partial y^2}$, $\frac{\partial^2 f}{\partial x \partial y}$ and evaluate these for $f(x, y) = 2x^4y^3$ at $x = 1, y = 1$ with $\Delta x = \Delta y = 0.1$ **(10 Marks)**

5 a. Use Rhomberg method to compute $I = \int_0^1 \frac{1}{1+x} dx$ correct to 3 decimal places. **(10 Marks)**

b. Evaluate $\int_0^1 \frac{x dx}{1+x^2}$ by i) Simpson's $1/3^{rd}$ rule taking 6 equal strips; ii) Simpson's 3/8 rule by taking 3 equal strips. **(10 Marks)**

6 a. Solve the initial value problem $u^1 = -2\ tu^2$, $u(0) = 1$ with $h = 0.2$ on the interval $[0, 0.4]$, using fourth order Runge-Kutta method. **(10 Marks)**

b. Applying Adams-Bash forth predictor-corrector method compute $y(x)$ at the specified value of x using the data given below

$$\frac{dy}{dx} = y - x^2$$

x	0	0.2	0.4	0.6
y	1	1.2186	1.4682	1.7379

Compute $y(0.8)$. **(10 Marks)**

7 a. Solve the boundary value problem $u'' = u + x$, $u(0) = 0$, $u(1) = 0$ with $h = 1/4$ by the finite difference method. **(10 Marks)**

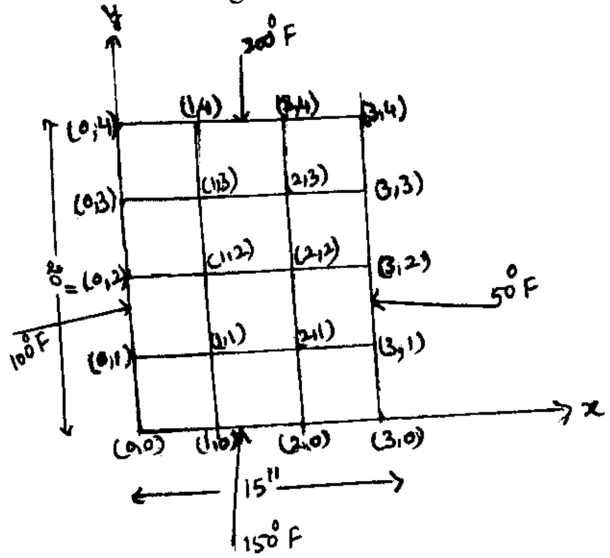
b. Solve the non-linear boundary value problem $u'' = u' + 1$, $u(0) = 1$, $u(1) = 2(e - 1)$ using II order method with $h = 1/3$. Compare with the exact solution $u(x) = 2e^x - x - 1$. **(10 Marks)**

8 a. Use the explicit method to solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ under the conditions

$u(0, t) = u(1, t) = 0, t \geq 0$

$u(x, 0) = \sin\pi x, 0 < x < 1$ with $h = 1/4$, $k = 1/96$. Integrate upto 2 time level. **(10 Marks)**

b. Determine the steady state temperature distribution in a rectangular plate of size $15'' \times 20''$ by solving the Laplace equation using $\Delta x = \Delta y = 5''$. The temperatures on the four sides of the plates are specified as indicated in figure below. **(10 Marks)**



* * * * *