B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination
December, 2010

ET-302(A) : COMPUTER PROGRAMMING & NUMERICAL METHODS

Time : 3 hours   Maximum Marks : 70

Note : Attempt *any five* questions. All questions carry *equal marks*.

1. (a) Write the statement of Taylor's theorem. Use it to expand $f(x) = x^4 - 5x^3 + 5x^2 + x + 2$ in powers of $(x - 2)$.

    (b) Find a real root of the equation : $3x + \sin x - e^x = 0$ by the method of false position correct to four decimal places. Choose suitable initial approximations.

2. (a) Give geometrical interpretation of Newton - Raphson method to find a root of $f(x) = 0$. Use it to evaluate $\sqrt{12}$ to four decimal places.

    (b) Find the inverse of the matrix A, using Gauss Jordan method

$$A = \begin{bmatrix} 3 & 1 & 2 \\ 2 & -3 & -1 \\ 1 & -2 & 1 \end{bmatrix}$$

3. (a) Determine the eigen values and the corresponding eigen vectors for the matrix :

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

(b) Construct a backward difference table from the data :

$\sin 30° = 0.5$, $\sin 35° = 0.5736$,

$\sin 40° = 0.6428$, $\sin 45° = 0.7071$,

Assuming third difference to be constant, find the value of $\sin 25°$.

4. (a) By means of Lagrange's formula prove that

$$y_1 = y_3 - 0.3\,(y_5 - y_{-3}) + 0.2\,(y_{-3} - y_{-5})$$

(b) Find the first and second derivatives of $f(x)$ at $x = 1.1$ from the following tabulated values :

x :	1.0	1.2	1.4	1.6	1.8	2
$f(x)$	0.0000	0.1280	0.5440	1.2960	2.4320	4.000

5. (a) Evaluate $\int_0^6 \dfrac{dx}{1+x^2}$ by using

(i) Simpson's one third rule.

(ii) Simpson's three eight rule.

(iii) Trapezoidal rule.

(b) Use Runge's method to approximate y when $x = 1.1$, given that

$y = 1.2$ when $x = 1$ and

$$\frac{dy}{dx} = 3x + y^2$$

6. (a) Write a FORTAN program to check whether a given number is prime or not.

(b) Draw a flow chart to arrange three numbers in decreasing order.

7. (a) Write a FORTAN program to compute average and standard deviation of numbers stored in an array.

(b) Explain with syntax different control constructs available in FORTAN.

8. Explain each of the following :
   (i) Truncation error.
   (ii) Convergence of an iterative method.
   (iii) Common files used for storing data.
   (iv) Local and global variables.
   (v) Equivalence declaration.

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