



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (EE-NEW)/SEM-3/CS-312/2010-11

2010-11

NUMERICAL METHODS AND PROGRAMMING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) The Newton-Raphson method is used to find the root of the equation $x^2 - 2 = 0$. If the iteration started from -1 , the iteration will

- a) converges to -1 b) converges to $\sqrt{2}$
c) converges to $-\sqrt{2}$ d) not convergent.

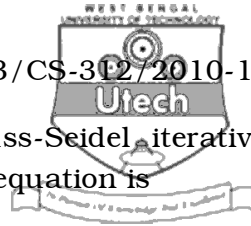
ii) Consider the sequence $x_{n+1} = \frac{x_n}{2} + \frac{9}{8x_n}$ ($n \geq 0$), $x_0 = 0.2$ obtained from Newton-Raphson method. The sequence converges to

- a) 1.5 b) $\sqrt{2}$
c) 1.6 d) 1.4 .

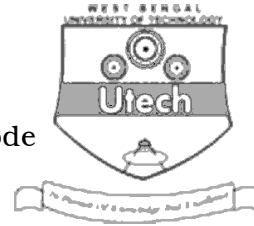
- a) $\frac{\sin x}{\pi}$ b) $\cos x$
- c) $\frac{\cos x}{\pi}$ d) none of these.

- }

- a) truncation error b) round off error
c) inherent error d) relative error.



- vii) The convergence condition for Gauss-Seidel iterative method for solving a system of linear equation is
- the coefficient matrix is singular
 - the coefficient matrix has rank zero
 - the coefficient matrix must be strictly diagonally dominant
 - none of these.
- viii) Recursive function may call
- another function
 - itself
 - both (a) & (b)
 - none of these.
- ix) Which of the following is a multistep method ?
- Euler's method
 - Predictor-corrector method
 - Taylor's series method
 - None of these.
- x) The rate of convergence of the Fixed point iteration method for solving $f(x) = 0$ is
- quadratic
 - biquadratic
 - cubic
 - linear.
- xi) The value of x after execution of the following statements :
- ```
int x, y = 12;
x = (y < 14) ? (y + 1) : (y - 1);
```
- is
- 10
  - 15
  - 12
  - 13.



xii) Output of the following programme code

```
{
 int a = 5, b = 3;
 a = a + b;
 b = a - b;
 a = a - b;
 printf ("a=%d, b=%d", a, b);
}
```

is

- a)  $a = 5, b = 3$                       b)  $a = 0, b = 5$   
 c)  $a = 3, b = 5$                       d) none of these.

### GROUP – B

#### ( Short Answer Type Questions )

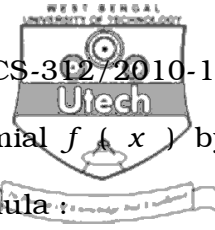
Answer any *three* of the following.  $3 \times 5 = 15$

2. Find the inverse of the following matrix by Gauss elimination method :

$$\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix} \quad 5$$

3. Prove that  $\Delta \log f(x) = \log \left[ 1 + \frac{\Delta f(x)}{f(x)} \right]$ . 5

4. a) Explain “closing a file” with the help of small programme segment in C.  
 b) Write a user defined recursive function to calculate factorial of  $n$ , where  $n$  is any integer number. 2 + 3



5. From the following table find the polynomial  $f(x)$  by Newton's divided difference interpolation formula :

|          |    |    |    |     |      |
|----------|----|----|----|-----|------|
| $x :$    | -1 | 0  | 3  | 6   | 7    |
| $f(x) :$ | 3  | -6 | 39 | 822 | 1611 |

5

6. Using Runge-Kutta method to fourth order solve  $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$  with  $y(0) = 1$  at  $x = 0.2$ .

### GROUP – C

#### ( Long Answer Type Questions )

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Find a real root of the equation  $f(x) = x^3 - 2x - 5 = 0$  using Regula falsi method correct to 3 decimal places.
- b) Prove that  $\mu^2 = 1/4(\delta^2 + 4)$ , where  $\mu$  = mean operator and  $\delta$  = central difference operator. 7 + 8
8. a) Find the value of  $y$  at  $x = 6$  from the following data, using Newton's divided difference formula. 7

|       |     |     |    |    |
|-------|-----|-----|----|----|
| $x :$ | 3   | 7   | 9  | 10 |
| $y :$ | 168 | 120 | 72 | 63 |



- b) Find the values of  $y$  at  $x = 0.1$  using Taylor's series method of the third order, given that  $dy/dx = 1/(x+y)$ ,  $y(0) = 2$ . 5

- c) Write difference between Euler's method and R.K. method. 3

9. a) Prove that Newton-Raphson method has a quadratic convergence.

- b) Use Gauss elimination method to solve the following equations :

$$2x + y + z = 10$$

$$3x + 2y + 3z = 18$$

$$x + 4y + 9z = 16 \quad 6 + 9$$

10. a) Evaluate  $\int_3^7 x^2 \log x \, dx$  by using Trapezoidal rule taking  $n = 4$ .

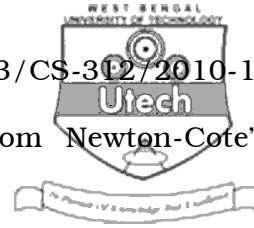
- b) Find the missing term in the following table :

|       |   |   |   |   |    |
|-------|---|---|---|---|----|
| $x :$ | 0 | 1 | 2 | 3 | 4  |
| $y :$ | 1 | 3 | 9 | — | 81 |

Explain why the result differs from  $3^3 = 27$ .

- c) Write a program in C to solve the equation  $x^3 + x^2 + x + 7 = 0$  within  $(-3, -2)$  by Bisection method.

4 + 4 + 7



11. a) Derive Simpson's one-third rule from Newton-Cote's quadrature formula.
- b) Solve the equation  $dy/dx = x + y$  with initial condition  $y(0) = 1.0$  and  $h = 0.1$ , using predictor-corrector method, to find  $y(0.2)$ .
- c) Write a program using recursive function to calculate the sum of all digits of any number.  $6 + 5 + 4$

=====