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 : $10 \times 1 = 10$

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

   a) 1·5 b) $\sqrt{2}$

   c) 1·6 d) 1·4.

iii) In iteration method $\left[x = \varphi(x)\right]$ for the equation $\pi x = \sin x$, the appropriate choice of $\varphi(x)$ such that sequence $x_0, x_1, x_2, \ldots\ldots x_n$ convergence to the root is

a) $\frac{\sin x}{\pi}$ b) $\cos x$

c) $\frac{\cos x}{\pi}$ d) none of these.

iv) What is the output of the following code ?

```
#include<stdio.h>
void main ( )
{
    int x = 2;
        x = x <<5; printf("%d",x);
}
```

a) 5 b) 2

c) 32 d) none of these.

v) When Gauss elimination method is used to solve $AX = B$, A is transformed to a/an

a) null matrix

b) upper triangular matrix

c) identity matrix

d) diagonally dominant matrix.

vi) The kind of error occurs when π approximated by 3·14 is

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

a) the coefficient matrix is singular

b) the coefficient matrix has rank zero

c) the coefficient matrix must be strictly diagonally dominant

d) none of these.

viii) Recursive function may call

a) another function b) itself

c) both (a) & (b) d) none of these.

ix) Which of the following is a multistep method ?

a) Euler's method

b) Predictor-corrector method

c) Taylor's series method

d) None of these.

x) The rate of convergence of the Fixed point iteration method for solving $f(x) = 0$ is

a) quadratic b) biquadratic

c) cubic d) linear.

xi) The value of x after execution of the following statements :

```
int x, y = 12;
x = (y<14)? (y+1):(y–1);
```

is

a) 10 b) 15

c) 12 d) 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 :

$$\begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$$ 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 $x = 0{\cdot}2$.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Find a real root of the equation $f(x) = x^3 - 2x - 5 = 0$ using Regula falsi method corrrect to 3 decimal places.

   b) Prove that $\mu^2 = 1/4\left(\delta^2 + 4\right)$, where μ = mean operator and δ = 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 $x = 0{\cdot}1$ 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 :

$2x + y + z = 10$

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

$x + 4y + 9z = 16$ 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 $y(0) = 1{\cdot}0$ and $h = 0{\cdot}1$, using predictor-corrector method, to find $y(0{\cdot}2)$.

c) Write a program using recursive function to calculate the sum of all digits of any number. 6 + 5 + 4