Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(OLD)/ECE,EEE,IT,ICE/SEM-3/M(CS)-312/2011-12

2011

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) Which of the following digits is not significant of the number 0·025 ?

   a) 0 b) 2

   c) 5 d) None of these.

   ii) Which of the following relations is true ?

   a) $1+\Delta = E$ b) $3+E = \Delta$

   c) $2+\Delta = E$ d) none of these.

iii) Which of the following methods is iterative method ?

a) Gauss Elimination Method

b) Gauss-Jordan Method

c) Gauss Jacoby Method

d) Crout's Method.

iv) The order of convergence of Newton-Raphson method is

a) 3 b) 2

c) 1 d) 4

v) If $f(3) = 5$ and $f(5) = 3$. then the linear interpolation function $f(x)$ is

a) $f(x) = 8 + x$ b) $f(x) = x^2$

c) $f(x) = 8 - x$ d) $f(x) = x + x^2 + 8$

vi) $(\Delta - \nabla)x^2$ is equal to (the notations have their usual meanings)

a) h^2 b) $-2h^2$

c) $2h^2$ d) none of these

vii) In Simpon's $\frac{1}{3}$rd rule, the portion of curve is replace by

a) straight line b) circular path

c) parabolic path d) none of these.

viii) If c be the actual value and e be its estimated value, the formula for relative error is

a) $\frac{a}{e}$ b) $\frac{|a-e|}{a}$

c) $\frac{(e-a)}{e}$ d) $\frac{|a-e|}{e}$

ix) In the method of iteration the function

$\phi(x)$ must satisfy

a) $|\phi'(x)|<1$ b) $|\phi'(x)|>1$

c) $|\phi'(x)|=1$ d) $|\phi'(x)|=2$.

x) Find the output of the following program :

```
main ( )
{
        char a, b ;
        a = 'b'
        b = a;
        printf ( "b = %c\n", b);
}
```

a) a b) b

c) garbage value d) none of these.

xi) The inherent error for Simpson's $\frac{1}{3}$ rd rule of integration is as (the notations have their usual meanings)

a) $-\frac{nh^5}{180}f''(x_0)$ b) $-\frac{nh^5}{140}f''(x_0)$

c) $-\frac{nh^3}{12}f''(x_0)$ d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. From the following table find the values of $f(12)$ by Newton's divided difference interpolation formula :

x :	11	13	14	18	19	21
$f(x)$:	1342	2210	2758	5850	6878	9282

3. Solve the following system by Gauss Elimination Method.

$2x + y + z = 10$

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

$x + 4y + 9z = 16.$

4. Find $\frac{d^2y}{dx^2}$ at $x = 7$ using the following table :

x :	0	2	4	6	8
$f(x)$:	3	9	17	21	35

5. Find the first approximation of the root lying between 0 & 1 of the equation $x^3 + 3x - 1 = 0$ by Newton-Raphson formula.

6. Solve by using Euler's method the following differential equation for $x = 1$ by taking $h = 0{\cdot}2$

$\frac{dy}{dx} = xy$, $y = 1$ when $x = 0$

GROUP – C

(Long Answer Type Questions)

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

7. a) Express $x^4 - 3x^2 + 1$ in factroial notation.

   b) Prove that third difference of a third degree polynomial is constant.

   c) Write a *C* program to solve the equation $x^3 - 3x - 5 = 0$ within (1, 2) by Bisection method correct up to 3 places of decimal. 5 + 5 + 5

8. a) Solve the following system of equation, correct to four places of decimals by Gauss- Seidel iteration method :

   $x + y + 54z = 110$'

   $27x + 6y - z = 85$

   $6x + 15y + 2z = 72$

b) Find the value of $y(0.1)$, $y(0.2)$ and $y(0.3)$ using Runge-Kutta Method of the fourth order, given that

$$\frac{dy}{dx} = xy + y^2, \quad y(0) = 1. \qquad 8 + 7$$

9. a) Find two missing term from the following distribution.

x :	0	1	2	3	4
y :	1	*	9	*	81

b) Write a program in *C* using recursive function to calculate the sum of all digits of any number.

c) Find the root of the equation $x^3 + x^2 + x + 7 = 0$ using Regulas Falsi method. 5 + 5 + 5

10. a) Write a *C* program to interpolate a given function at a specified argument by Divided difference interpolation formula.

b) Write a *C* program to approximate a real root of the following equation :

$4 \cos x = e^{2x}$ by Bisection method. 8 + 7

11. a) Solve the following system of equations by LU factorization method :

$2x - 6y + 8z = 24$

$5x + 4y - 3z = 2'$

$3x + y + 2z = 16$

b) Write a program in *C* using recursive function to calculate the GCD of any two given numbers. 8 + 7