

Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (IT, ECE, EEE, ICE)/SEM-3/M(CS)-312/2009-10

2009

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) If the interval of differencing is unity and $f(x) = ax^2$ ('a' is a constant) which of the following choices is wrong ?

- | | |
|------------------------------|-------------------------|
| a) $\Delta f(x) = a(2x + 1)$ | b) $\Delta^2 f(x) = 2a$ |
| c) $\Delta^3 f(x) = 2$ | d) $\Delta^4 f(x) = 0.$ |

ii) The number of significant figures in 6,00,000 is

- | | |
|------|-------|
| a) 1 | b) 7 |
| c) 0 | d) 6. |

iii) Which of the following is *true* ?

- | | |
|------------------------------|------------------------|
| a) $\Delta^n x^n = (n + 1)!$ | b) $\Delta^n x^n = n!$ |
| c) $\Delta^n x^n = 0$ | d) $\Delta^n x^n = n.$ |



- iv) When Gauss elimination method is used to solve $AX = B$, A is transformed to a
- unit matrix
 - lower triangular matrix
 - diagonally dominant matrix
 - upper triangular matrix.
- v) The method of iteration formula $\phi(x)$ must satisfy
- $|\phi'(x)| < 1$
 - $|\phi'(x)| > 1$
 - $|\phi'(x)| = 1$
 - $|\phi'(x)| = 2$.
- vi) Regula-Falsi method is
- conditionally convergent
 - linearly convergent
 - divergent
 - none of these.
- vii) Which of the following is *true* ?
- $E = 1 - \Delta$
 - $E = 1 + \Delta$
 - $\Delta = 1 + E$
 - $E = 1/\Delta$.
- viii) The order of h in the error expression of Trapezoidal rule is
- 6
 - 3
 - 5
 - 2.
- ix) The degree of precision of Simpson's one third rule is
- 1
 - 2
 - 3
 - 5.



x) Which of the following methods is an iterative method ?

- a) Gauss Elimination method
- b) Gauss-Jordan method
- c) Gauss-Seidel method
- d) Crout's method.

xi) main ()

```
{
    print("%x",-1<<4);
}
```

- a) 0
- b) F0
- c) FFFF
- d) FFF0.

xii) main ()

```
{
    char s[] = {'a','b','c','\n','c','\0'};
    char *p, *str, *str1;
    p=&s[3];
    str=p;
    str1=s;
    printf("%d",++*p + ++*str1-32);
}
```

- a) 177
- b) 122
- c) 77
- d) 277.



xiii) main ()

```
{
    int a=2, *f1, *f2;
    f1=f2=&a;
    *f2+= *f2+=a+=2*5;
    printf("\n%d %d %d", a, *f1, *f2);
}
```

- a) 16 15 14 b) 16 16 16
c) 16 15 16 d) 24 24 24.

xiv) main ()

```
{
    printf("\nab");
    printf("\bsi");
    printf("\rha");
}
```

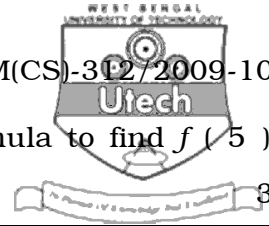
What will be the output for the above code ?

- a) hai_ b) ha
c) h d) ab

GROUP – B (Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. a) What is the difference between interpolation and extrapolation ? Give suitable examples. 2
- b) If $y(10) = 35.3$, $y(15) = 32.4$, $y(20) = 29.2$, $y(25) = 26.1$, $y(30) = 23.2$ and $y(35) = 20.5$, find $y(12)$ using Newton's forward interpolation formula. 3



3. a) Use Newton's divided difference formula to find $f'(5)$ from the following data : 3

X	0	2	3	4	7	8
$f(x)$	4	26	58	112	466	668

- b) What do you mean by geometrical interpretation of Simpson's $\frac{1}{3}$ rd rule ? 2
4. a) Find the values of $y'(x)$ and $y''(x)$ at $x = 1.1$ from the following data, using Newton's forward interpolation formula : 3

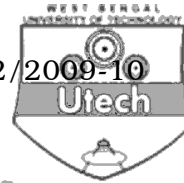
X	1.0	1.2	1.4	1.6	1.8	2.0
Y	0	0.128	0.544	1.296	2.432	4

- b) What is ternary operator ? Give examples. 2
5. a) Find the approximate value of $I = \int dx/(1+x)$ when the interval is $(0, 1)$ and $h = \frac{1}{2}$. Use trapezoidal rule. 3
- b) Show that $\Delta \log f(x) = \log [1 + \Delta f(x) / f(x)]$, where Δ is the forward difference operator. 2

6. Solve by using Euler's method the following differential equation for $x = 1$ by taking $h = 0.2$:

$$dy/dx = xy, y = 1 \text{ when } x = 0. \quad 5$$

7. Find the smallest positive root of the equation $3x^3 - 9x^2 + 8 = 0$ correct to 4 places of decimals, using Newton-Raphson method.



GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following.

3 × 15 = 45

8. a) Solve the system of linear equations by Gauss Elimination method :

$$5x_1 - x_2 = 9$$

$$-x_1 + 5x_2 - x_3 = 4$$

$$-x_2 + 5x_3 = -6.$$

7

- b) Find the Newton-Raphson iterative formula to find the p th root of positive number N and hence find the cube-root of 17.

5

- c) Evaluate the following :

3

$$\Delta^2 \left\{ (5x+12)/(x^2+5x+6) \right\}, \text{ taking } h = 1$$

9. a) Write a C program to interpolate a given function as specified argument by divided difference formula.

7

- b) Compute $I = \int x/\sin x \, dx$, where the interval is (0, 1/2) using Simpson's rule with $h = 1/4$.

5

- c) Deduce trapezoidal rule for Newton-Cote's quadrature formula.

3



10. a) Find the inverse of the following matrix.

5

$$\begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$$

- b) Solve the following system of equations by

LU factorization method :

5

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

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

$$3x + y + 2z = 16$$

- c) Evaluate $\int x e^x dx$ where the interval is (0, -1) by

using Trapezoidal rule taking $n = 6$.

5

11. a) Write a C program to solve the equation $x^3 - 3x - 5 = 0$

within (1, 2) by Bisection method correct upto 3 places

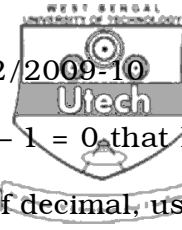
of decimal.

8

- b) Write a program in C using recursive function to

calculate the GCD of any two given numbers.

7



12. a) Find the root of the equation $3x - \cos x - 1 = 0$, that lies between 0 and 1, correct to four places of decimal, using bisection method. 7
- b) Find the root of the equation $x^3 - 5x - 7 = 0$, that lies between 2 and 3, correct to 4 places of decimals, using the method of false position. 7
- c) State the condition of convergence of Newton-Raphson method. 1
13. a) Solve the following system of equations, correct to four places of decimals, by Gauss-Seidel iteration method : 8
- $$x + y + 54z = 110$$
- $$27x + 6y - z = 85$$
- $$6x + 15y + 2z = 72$$
- b) Find the values of $y (0.1)$, $y (0.2)$ and $y (0.3)$ using Runge-Kutta method of the fourth order, given that
- $$dy/dx = xy + y^2, y(0) = 1. \quad 7$$
