

Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech(OLD)/EEE,ICE,IT,ECE/SEM-3/M(CS)-312/2012-13

2012

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 relations is true ?

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

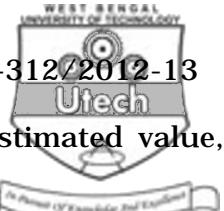
c) $E = 1/\Delta$ d) None of these.

ii) By evaluating $\int_0^1 \frac{dx}{1+x^2}$ by a numerical integration

method, we can obtain an approximate value of

a) $\log_e 2$ b) π

c) e d) $\log_{10} 2$.



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iii) If a 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) $\frac{ a - e }{e}$. |

iv) In Trapezoidal rule, the portion of curve is replaced by

- | | |
|-------------------|-------------------|
| a) straight line | b) circular path |
| c) parabolic path | d) none of these. |

v) The error involved in 4th order R-k method is given by

- | | |
|-------------|---------------|
| a) $O(h^2)$ | b) $O(h^4)$ |
| c) $O(h^3)$ | d) $O(h^5)$. |

vi) An $n \times n$ matrix A is said to be diagonally dominant if

a) $|a_{ii}| \leq \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$

b) $|a_{ii}| < \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$

c) $|a_{ii}| > \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$

d) $|a_{ii}| \geq \sum_{\substack{j=1 \\ i \neq j}}^n |a_{ij}|$.



vii) 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.

viii) Lagrange's interpolation formula is used for

- a) equispaced arguments only
- b) unequispaced arguments only
- c) both equispaced and unequispaced arguments
- d) none of these.

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

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



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x) If $f(x) = \frac{1}{x}$, the divided difference $[a, b, c]$ is

- | | |
|--------------------------|-----------------------|
| a) $\frac{1}{a+b+c}$ | b) $\frac{1}{abc}$ |
| c) $\frac{1}{a^2 + b^2}$ | d) $\frac{1}{a+b-c}.$ |

xi) If $\frac{dy}{dx} = x + y$ and $y(1) = 0$, then $y(1.1)$ according to Euler's method is $[h = 0.1]$

- | | |
|--------|---------|
| a) 0.1 | b) 0.3 |
| c) 0.5 | d) 0.9. |

xii) Which one of the following results is correct ?

- | | |
|----------------------------|-------------------------------|
| a) $\Delta x^n = nx^{n-1}$ | b) $\Delta x^n = nx^{n+1}$ |
| c) $\Delta^n e^x = e^x$ | d) $\Delta \cos x = -\sin x.$ |

xiii) 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.$ |

xiv) 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. |



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

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 Matrix Inversion Method :

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

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

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

4. a) Evaluate the missing terms in the following table :

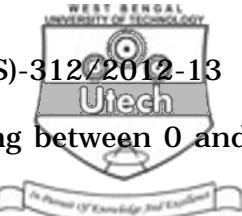
x :	0	1	2	3	4	5
f(x) :	0	—	8	15	—	35

- b) What is ternary operator ? Give an example.

5. a) Solve by Taylor's series method $\frac{dy}{dx} = 2x + 3y^2$, given

$y = 0$ when $x = 0$ at $x = 0.2$.

- b) Using Euler's method obtain the solution of
 $\frac{dy}{dx} = x - y$, with $y(0) = 1$ and $h = 0.2$ at $x = 0.4$.



6. Find the first approximation of the root lying between 0 and 1 of the equation

$x^3 + 3x - 1 = 0$ by Newton-Raphson formula.

7. Find $y'(x)$, $y''(x)$, given

$x :$	0	1	2	3	4
$f(x) :$	1	1	15	40	85

GROUP – C
(Long Answer Type Questions)
 Answer any three of the following. $3 \times 15 = 45$

8. a) From the following table, estimate the number of students who obtained marks between 40 and 45 :

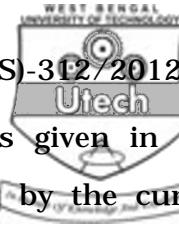
Marks :	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of Students :	31	42	51	35	31

- b) Using Newton's divided difference formula, evaluate $f(8)$ and $f(15)$, given :

X :	4	5	7	10	11	13
f(X) :	48	100	294	900	1210	2028

$7 + 8$

9. a) Find the positive real root of $x^3 = 18$ using the bisection method of 4 iterations.
- b) Find the root of the equation $x^3 + x^2 + x + 7 = 0$ using Regula Falsi method.



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- c) A curve passes through the points as given in the following table. Find the area bounded by the curve, x -axis, $x = 1$ and $x = 9$:

X	1	2	3	4	5	6	7	8	9
Y	0.2	0.7	1	1.3	1.5	1.7	1.9	2.1	2.3

5 + 5 + 5

10. a) Write a program in C to solve the equation $x^3 - 3x - 5 = 0$ within (1, 2) by Bisection method correct up to 3 places of decimal.
- b) Write a program in C using recursive function to calculate the sum of all digits of any number. 8 + 7

11. a) Evaluate $\int_0^1 xe^x dx$ by using Trapezoidal rule taking

$$n = 6.$$

- b) Use Lagrange's interpolation formula to find the value of $f(x)$ for $x = 0$, given the following :

x :	- 1	- 2	2	4
f(x) :	- 1	- 9	11	69

- c) Prove that Newton-Raphson method has a quadratic convergence. 5 + 5 + 5



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12. a) Solve the following system of equations by $L - U$ Factorization Method :

$$x_1 + x_2 - x_3 = 2$$

$$2x_1 + 3x_2 + 5x_3 = -3$$

$$3x_1 + 2x_2 - 3x_3 = 6.$$

- b) Solve the following set of equations by Gauss-Seidel method correct to 2 places of decimal :

$$9x - 2y + z = 50$$

$$x + 5y - 3z = 18$$

$$-2x + 2y + 7z = 19.$$

- c) Write a C program to approximate a real root of the following equation :

$$4 * \sin(x) = e^x \text{ by Bisection method.} \quad 5 + 5 + 5$$

13. a) Write a C program to interpolate a given function at a specified argument by Lagrange's interpolation formula.

- b) Find the value of $\log 2^{1/3}$ from $\int_0^1 \frac{x^2}{1+x^3} dx$ using Simpson's $\frac{1}{3}$ rd rule with $n = 4$.

- c) Calculate the approximate value of $\int_0^{\pi/2} \sin x dx$ by

Composite Trapezoidal Rule by using 11 ordinates. Also compare it with the actual value of the integral.

5 + 5 + 5