



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 × 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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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) $f(x) = x + x^2 + 8$.



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.

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

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

(Short Answer Type Questions)

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

$$\begin{aligned} 2x + y + z &= 10 \\ 3x + 2y + 3z &= 18 \\ x + 4y + 9z &= 16. \end{aligned}$$

$\mathbf{x}:$	0	1	2	3	4	5
$\mathbf{f}(\mathbf{x}):$	0	—	8	15	—	35

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

$$x^3 + 3x - 1 = 0 \text{ by Newton-Raphson formula.}$$

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 :

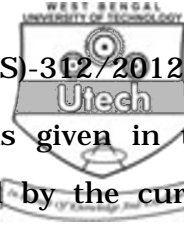
Marks :	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of Students :	31	42	51	35	31

- 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.



- 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 $\int_0^1 x e^x dx$ 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



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