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CS/B.TECH(EE-OLD)/SEM-3/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) The number of significant digits in 0.04505910 is
 - a) 8

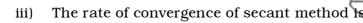
b) 7

c) 6

- d) 5
- ii) Overflow occurs due to
 - a) division by a very large number
 - b) division by a very small number
 - c) both (a) and (b)
 - d) none of these.

3105-(O) [Turn over

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a) 2

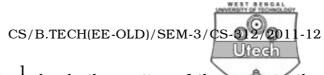
b) 1

c) 0.62

- d) 1.62
- iv) If f(x) be a polynomial of degree n, then
 - a) $(n + 1)^{th}$ order forward difference exists
 - b) $(n-1)^{th}$ order forward difference exists
 - c) n^{th} order forward difference exists
 - d) none of these.
- v) Which of the following does not always guarantee convergence?
 - a) Bijection method
 - b) Newton-Raphson method
 - c) Regula-falsi method
 - d) none of these.
- vi) If $f(x) = \frac{1}{x}$ then divided difference [a , b, c] is
 - a) $\frac{1}{a} \frac{1}{b} \frac{1}{c}$
- b) $\left(\frac{1}{a} \frac{1}{b}\right) \left(\frac{1}{b} \frac{1}{c}\right)$

c) $\frac{1}{abc}$

- d) $\left(\frac{1}{a} \frac{1}{b}\right) + \left(\frac{1}{b} \frac{1}{c}\right)$
- vii) Which of the following relations is true?
 - a) $\Delta = E 1$
- b) $\Delta, \nabla = \Delta \nabla$
- c) $\Delta, \nabla = \Delta + \nabla$
- d) $\Delta = 1 E$



viii) In Simpson's $\frac{1}{3}$ rd rule the portion of the curve in the interval $[x_{i-1}, x_{i+1}]$ is replaced by

- a) straight line
- b) parabola
- c) hyperbola
- d) a cubic polynomial.
- ix) What will be the output of the following program segment?

```
main ( )
```

int x, y, z;

x = 7;

y = x + + ;

z=++;

prinf ("%d, %d", y, z)

}

a) 7, 8

b) 7, 9

c) 8, 9

d) none of these.

3105-(O)

3

[Turn over



- x) Which of the following statements is / are false:
 - A. Gaussian elimination method is a direct method
 - B. Gaussian elimination method has a computational complexity $O(n^3)$
 - C. Gaussian elimination method solves any system of linear simultaneous equations
 - D. Gaussian elimination method reduces the coefficient matrix in upper triangular form.
 - a) (C) only
- b) both (B) and (C)
- c) (B) only
- d) all are true.
- xi) Consider the following program segment :

```
for (i = 1, sum = 0; i \leq 10; i + +) { scanf ("%d", & x); if (x < 0) continue; sum + = x;
```

}

The value of "sum" with input 1,-2,-3,2,4,-3,5,1,3,-1 is

a) 5

b) 1

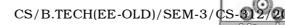
c) 16

- d) 7
- xii) Truncation error associated with Runge-Kutta 4th order formula is of the order of
 - a) h^2

b) h^3

c) h^4

d) h^5



GROUP - B

(Short Answer Type Questions)

Answer any three of the following.



2. Solve the following system of linear simultaneous equations by Gaussian elimination method.

$$2x + y + 4z = 16$$

$$3x + 2y + z = 10$$

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

3. Find a root of the following non-linear equation corrected up to 3 decimal places.

$$x^3 - 2x - 5 = 0$$

Take
$$x_0 = 1$$
 and $x_1 = 2$

4. Evaluate $\int_{0}^{1} \frac{1}{1+x} dx$ using Simpson's $\frac{1}{3}$ rule.

Take h = 0.1.

- 5. What do you mean by "Entry Control Loop" and "Exit Control Loop"? What is a void pointer?
- 6. Given the following table of values :

х	4	5	7	10
f(x)	48	100	294	900

Calculate f (8) using Lagrange's formula.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

- 7. a) Derive the condition of convergence of Gauss-Seidel iterative method for solution of linear simultaneous equations.
 - b) Write a C program to implement Trapezoidal method. Result is required to be corrected up to n decimal places. The limits of integration and the value of n (precision) are to be taken as input. 7+8
- 8. a) Solve the following system of equation by LU-factorization method.

$$x + 3y + 8z = 4$$

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

$$x + 3y + 4z = 1$$

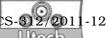
b) Given the following differential equation $\frac{\mathrm{d}y}{\mathrm{d}x} = x + y + xy, \ y(0) = 1$

Calculate y at x = 0.1 taking h = 0.02.

8 + 7

- 9. a) Define Δ, ∇ and E. Hence derive Newton's forward difference formula.
 - b) Derive the order of convergence for Newton-Raphson method
 - c) Evaluate $\sqrt{5}$ corrected up to 4 decimal places using Newton-Raphson method. 5+5+5

3105-(O)



- 10. a) Write a C program to create the divided difference table.
 - b) Prove that $\Delta, \nabla = \frac{\Delta}{\nabla} \frac{\nabla}{\Delta}$



- 11. a) Derive the truncation error associated with Trapezoidal method.
 - b) Find y (0·26) from the following tabular values using Newton's Backward difference formula:

Х	0.10	0.15	0.20	0.25	0.30
у	0.1003	0.1511	0.2027	0.2553	0.3093

c) Compute the absolute error and relative error associated with division of two approximate numbers A and B. 5+5+5

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