



Name :

Roll No. :

Invigilator's Signature :

CS/BCA/SEM-4/BM-401/2012

2012

STATISTICS, NUMERICAL METHODS & ALGORITHMS

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 :

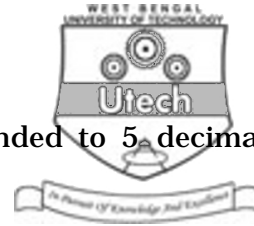
10 × 1 = 10

i) The number of significant digits in 1.00234 is

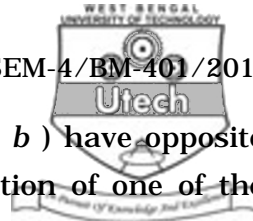
- a) 3
- b) 4
- c) 5
- d) 6.

ii) The relation between shift operator E and forward difference operator Δ is given by

- a) $\Delta = 1 + E$
- b) $E = 1 + \Delta$
- c) $E = \Delta$
- d) $E = \Delta + 2.$



- iii) When the number 1.004355 is rounded to 5 decimal places, then it becomes
- a) 1.00436 b) 1.00435
c) 1.00434 d) none of these.
- iv) The order of convergence of Newton-Raphson method is
- a) 3 b) 2
c) 1 d) 4.
- v) Lagrange's interpolation formula is used for
- a) only equispaced values
b) only unequispaced values
c) both equispaced & unequispaced values
d) none of these.
- vi) The number of sub-intervals required for Simpson's $\frac{1}{3}$ rule of numerical integration is
- a) even b) odd
c) even or odd d) none of these.
- vii) The error in Runge-Kutta method of 4th order is
- a) $O(h^2)$ b) $O(h^3)$
c) $O(h^4)$ d) $O(h^5)$.
- viii) The sum of the approximate numbers 2.56, 4.56273, 1.253, 1.05342 is
- a) 9.4291 b) 9.429
c) 9.43 d) 9.5.



ix) Under the condition that $f(a)$, $f(b)$ have opposite signs and $a < b$, the first approximation of one of the roots of $f(x) = 0$ by Regula-Falsi method is given by

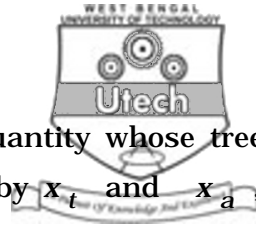
- a) $\frac{bf(a) + af(b)}{f(a) + f(b)}$
 b) $\frac{af(a) - bf(b)}{f(a) - f(b)}$
 c) $\frac{af(b) - bf(a)}{f(b) - f(a)}$
 d) $\frac{af(a) + bf(b)}{f(a) + f(b)}$.

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

- a) Gauss elimination b) Gauss-Jordan
 c) Gauss-Jacobi d) Gauss-Seidel.

xi) A system of equations $AX = b$ where $A = (a_{ij})_{n \times n}$ is said to be diagonally dominant if

- a) $|a_{ii}| > \sum_{\substack{j=1 \\ j \neq i}}^n |a_{ij}|$ for all i
 b) $|a_{ii}| < \sum_{\substack{j=1 \\ j \neq i}}^n |a_{ij}|$ for all i
 c) $|a_{ii}| > \sum_{j=1}^n |a_{ij}|$ for all i
 d) $|a_{ii}| < \sum_{j=1}^n |a_{ij}|$ for all i .



xii) If E_a is the absolute error in a quantity whose true and approximated values are given by x_t and x_a , then the relative error is given by

- a) $\left| \frac{E_a}{x_a} \right|$ b) $\left| \frac{E_a}{x_t} \right|$
- c) $\left| \frac{E_a}{x_t - x_a} \right|$ d) $| E_a |$.

xiii) When the Gauss elimination method is used to solve $BX = A$, B is transformed into

- a) a lower triangular matrix
- b) a unit matrix
- c) a singular matrix
- d) an upper triangular matrix.

xiv) When $x = \phi(x)$ admits a real root in $[a, b]$, then

- a) $|\phi'(x)| < 1$
- b) $|\phi'(x)| > 1$
- c) $|\phi'(x)| = 1$
- d) none of these.

xv) The degree of precision of Simpson's $\frac{1}{3}$ rd rule is

- a) 1 b) 2
- c) 3 d) none of these.

**GROUP - B****(Short Answer Type Questions)**

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

2. Compute $f(b)$ from the following table using Newton's Divided Difference Formula :

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

3. Find the missing term in the following table :

x	0	1	2	3	4
f(x)	1	3	9	—	81

4. Compute $y(0.2)$ from the equation

$$\frac{dy}{dx} = x - y ; y(0) = 1, \text{ taking } h = 0.1, \text{ by Runge-Kutta}$$

method of fourth order, correct to five decimal places.

5. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Weddle's rule, taking $n = 6$

correct to 4 decimal places.

6. Find a root of $e^{-x} - 3x = 0$ correct to two decimal places, using the method of fixed point iteration.

7. Find a real root of the equation $x^3 - 2x = 5$ by Regula-Falsi method correct up to 2 significant digits.



GROUP - C

(Long Answer Type Questions)

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

8. a) Find the inverse of the matrix $\begin{pmatrix} 2 & -2 & 4 \\ 2 & 3 & 2 \\ -1 & 4 & -1 \end{pmatrix}$ by

Gauss-elimination method.

- b) Solve the following system of equations by LU-factorization method :

$$5x + 2y + z = -12$$

$$-x + 4y + 2z = 20$$

$$2x - 3y + 10z = 3 \qquad 7 + 8$$

9. a) Given the table of $y = \log_{10} (x + 2)$ with spacing $h = 1$, find the value of $y'(0)$ and $y''(4)$.

x :	0	1	2	3	4
y :	0.3010	0.4771	0.6020	0.6990	0.7782

- b) Find a real root of $x^3 - 4x = 9$ correct up to 3 decimal places by bisection method. $8 + 7$

10. a) Find $y(0.10)$ and $y(0.15)$ by Euler's method from the differential equation :

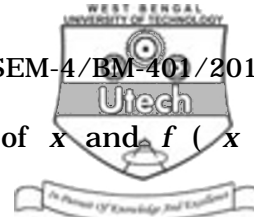
$$\frac{dy}{dx} = x^2 + y^2, \quad y(0) = 0$$

correct up to 4 decimal places, taking $h = 0.05$.

- b) The value of x and y are given below :

x :	5	6	9	11
y :	12	13	14	16

Find the value of y when $x = 10$ using Lagrange's interpolation formula. $8 + 7$



11. a) From the following table of values of x and $f(x)$ determine $f(0.29)$:

	x	0.22	0.24	0.26	0.28	0.30
	f(x)	1.6698	1.6804	1.6912	1.7024	1.7139

- b) Using Taylor's series method find y at $x = 1.1, 1.2$ by solving $\frac{dy}{dx} = (x^2 + y^2)$ given by $y(1) = 2.3$.

7 + 8

12. a) Solve the following system of linear equations by Gauss-Seidel method of iteration (correct up to 3 decimal places) :

$$10x + y + z = 12$$

$$2x + 10y + z = 13$$

$$2x + 2y + 10z = 14.$$

- b) Write Algorithm for finding the equation by Newton-Raphson method.

8 + 7

13. a) Solve by Euler's modified method, the following differential equation for $x = 0.02$ taking $h = 0.01$:

$$\frac{dy}{dx} = x^2 + y, \quad y(0) = 1.$$

- b) Solve the equation

$$\frac{dy}{dx} = x + y, \quad y(0) = 1 \text{ at } x = 0.2,$$

by Picard's method (take only three integrations). 8 + 7

=====