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 :

$10 \times 1 = 10$

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 usd 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) $0(h^2)$ b) $0(h^3)$

c) $0(h^4)$ d) $0(h^5)$.

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) $\dfrac{bf(a) + af(b)}{f(a) + f(b)}$

b) $\dfrac{a\,f(a) - b\,f(b)}{f(a) - f(b)}$

c) $\dfrac{a\,f(b) - b\,f(a)}{f(b) - f(a)}$

d) $\dfrac{a\,f(a) + b\,f(b)}{f(a) + f(b)}$.

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 $A = \left(a_{ij}\right)_{n \times n}$ 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 tree 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 he 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 $y(0{\cdot}2)$ from the equation $\frac{dy}{dx} = x - y$; $y(0) = 1$, taking $h = 0{\cdot}1$, 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 :

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

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

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

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

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 $y(0{\cdot}10)$ and $y(0{\cdot}15)$ 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 $h = 0{\cdot}05$.

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 $f(0{\cdot}29)$:

	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 $x = 1{\cdot}1, 1{\cdot}2$ by solving $\frac{dy}{dx} = (x^2 + y^2)$ given by $y(1) = 2{\cdot}3$.

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 $x = 0{\cdot}02$ taking $h = 0{\cdot}01$:

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

b) Solve the equation

$$\frac{dy}{dx} = x + y, \quad y(0) = 1 \text{ at } x = 0{\cdot}2,$$

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