Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/BCA/SEM-4/BM-401/2011

2011
STATISTICS, NUMERICAL METHODS AND 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 digit in 0·00303 is

      a) 6 b) 5

      c) 3 d) none of these.

   ii) When rounded off after 4 decimal places 0·003256 becomes

      a) 0·0032 b) 0·0033

      c) 0·0326 d) none of these.

iii) Divided difference formula is used for

a) equispaced point

b) unequally spaced points

c) both (a) & (b)

d) none of these.

iv) Newton's forward formula is used for interpolating the value of y near the

a) beginning of a set

b) end of a set

c) central of the set

d) none of these.

v) In backward difference $\nabla^2 f(x)$ is

a) $\nabla f(x) - \nabla f(x+h)$ b) $\nabla^2 f(x) - \nabla^2 f(x-h)$

c) $\Delta f(x) - \Delta f(x+h)$ d) none of these.

vi) The iterative method to solve a system of equation is

a) Gauss-elimination b) Gauss-Jordan

c) Gauss-Seidel d) None of these.

vii) The error in the Simpson's $\frac{1}{3}$rd method is of order

a) h b) h^2

c) h^3 d) h^4.

viii) Newton-Raphson method fails when

a) $f^{I}(x) = 0$ b) $f^{I}(x) > 0$

c) $f^{I}(x) < 0$ d) none of these.

ix) Diagonal dominance is must for

a) Gauss-Seidel method

b) Gauss-Jordan's matrix inversion method

c) Gauss elimination method

d) none of these.

x) The second order Runge-Kutta formula has a truncation error which is of order of

a) h^2 b) h^3

c) h^4 d) none of these.

xi) The order of h in the error expression of trapezoidal rule is

a) 1 b) 2

c) 3 d) 4.

xii) Relative error in numerical method where x_T = true value of solution $\neq 0$, x_A = Approximate value of solution is

a) $|x_T - x_A|$ b) $\frac{|x_T - x_A|}{x_T}$

c) $\frac{|x_T - x_A|}{x_T} \times 100$ d) none of these.

xiii) Which is the direct method ?

a) Gauss-elimination method

b) Gauss-Jacobi method

c) Gauss-Seidel method

d) none of these.

xiv) Newton-Raphson method is also known as

a) chord method b) tangent method

c) secant method d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. By means of Newton's divided differential interpolation formula find the value of $f(8)$ from the following table :

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

3. Prove that for small values of 'h' $\Delta^{n+1} f(x_0) \approx h^{n+1} f^{n+1}(x_0)$.

4. Evaluate $\int_0^1 \cos x \, dx$ taking five equal intervals. Explain the reason behind your choice of integration formula used.

5. Compute $f(1{\cdot}42)$ from the following data :

x	1·1	1·2	1·3	1·4
$f(x)$	7·831	8·728	9·697	10·744

6. Solve $\frac{dy}{dx} = x^2y - 1$, where $y(0) = 1$ by Taylor's series method. Also find $y(0{\cdot}1)$ correct to seven significant digits.

7. How many digits are to be taken in computing $\sqrt{13}$ so that error does not exceed 0·1% ?

GROUP – C

(Long Answer Type Questions)

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

8. a) Compute $f(1{\cdot}16)$ from the following table :

x	1·11	1·12	1·13	1·14	1·15	1·16
$f(x)$	6·2321	6·2544	6·2769	6·2996	6·3225	6·3456

b) Find the positive root of the equation $x^2 + 2x - 2 = 0$, correct up to 2 significant figures by Newton-Raphson method.

c) Estimate the missing term from the table :

x	2	4	6	8	10
y	5	13	$*$	53	85

9. a) Solve the following system of linear equations by Gauss-Seidel method :

$6x + 15y + 2z = 72$

$27x + 6y - z = 85$

$x + y + 54z = 110.$

b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's one-third rule taking $h = \frac{1}{6}$ correct up to 3 decimal places.

c) Find the root of the equation $x \log_{10} x = 1 \cdot 2$, correct to 2 decimal places by Bisection method. 6 + 4 + 5

10. a) Solve by Gauss elimination method :

$x + 2y + 3z = 10$

$x + 3y - 2z = 7$

$2x - y + z = 5$.

b) Evaluate $\int_0^1 \left(4x - 3x^2\right) dx$ taking 10 intervals by Trapezoidal rule and then find the absolute error.

c) Prove that $E = e^{hD}$, $D = \frac{d}{dx}$ and E is the shift operator. 7 + 5 + 3

11. a) Use Euler's method to find the solution of $\frac{dy}{dx} = x - y$ with $y(0) = 1$, $h = 0{\cdot}2$ at $x = 0{\cdot}4$.

b) Find the value of $y(0{\cdot}2)$ by 4th order Runge-Kutta method which is correct to *four* decimal places, where $\frac{dy}{dx} = y^2 - x^2, y(0) = 1$ taking $h = 0{\cdot}1$. 7 + 8

12. a) Compute a root of the equation $x^2 e^{-x/2} = 1$ in the interval [0, 2] by secant method correct to 3 decimal places.

b) Find the inverse of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$ by Gauss' method. 7 + 8

13. a) Solve the following equation by Jacobi's iteration method :

$10x - 2y - z - w = 3$

$-2x + 10y - z - w = 15$

$-x - y + 10z - 2w = 27$

$-x - y - 2z + 10w = -9$

b) Solve by LV factorization method :

$2x - 3y + z = -1$

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

$x - 4y + z = -6$ 7 + 8