2014

Statistics, Numerical Methods & Algorithms

Time Alloted : 3 Hours   *Full Marks : 70*

The figure 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:

                                                        10x1=10

   i) The relative percentage error in approximate representation of 4/3 as 1.33 is

      a) 25%

      b) 2.5%

      c) .25%

      d) 0.025%

   ii) First order forward difference of a constant function is

      a) 0

      b) 4

      c) 3

      d) 1

2064   1   [Turn over]

iii) When the no 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) For Trapezoidal rule of numerical integration, the number of sub-intervals should be

    a) Even

    b) Odd

    c) Even or odd

    d) Multiple of three

v) When the Guass elimination method is used to solve BX= A, B is transformed into

    a) A lower triangular matrix

    b) Zero matrix

    c) An upper triangular matrix

    d) None of these

vi) The order of convergence of Regula-falsi method is

    a) 1

    b) 1.52

    c) 1.62

    d) 2

vii) Which of the following methods give faster convergence?

    a) Gauss-Jacobi Method

    b) Gauss- Seidel Method

    c) Gauss-Elimination Method

    d) Gauss-Jordan Elimination Method

viii) The condition of convergence for the method of fixed point iteration is

    a) $|\varphi'(x)| < 1$

    b) $|\varphi'(x)| > 1$

    c) $|\varphi'(x)| \leq 1$

    d) $|\varphi'(x)| \geq 1$

ix) The truncation error in 4th order Runge-Kutta Method is of the

    a) $O(h^2)$

    b) $O(h^3)$

    c) $O(h^4)$

    d) $O(h^5)$

x) A system of linear equations is said to be diagonally dominant if its coefficient matrix satisfy

    a) $|aii| \leq \sum |aij|$

    b) $|aii| \geq \sum |aij|$

    c) $|aii| > \sum |aij|$

    d) $|aii| < \sum |aij|$

xi) If a number be rounded off to m decimal places, then the absolute error

    a) $E_a \leq \dfrac{1}{2}10^{-m}$

    b) $E_a \leq \dfrac{1}{2}10^{m}$

    c) $E_a \geq \dfrac{1}{2}10^{-m}$

    d) $E_a \geq \dfrac{1}{2}10^{m}$

xii) Weddle's rule gives exact result for a polynomial of degree

     a) ≤ 5

     b) $= 6$

     c) ≤ 7

     d) $= 8$

GROUP - B
(Short Answer Type Questions)
Answer any *three* of the following.   3x5=15

2. When h=1, prove that

$$\Delta\left\{\frac{1}{f(x)}\right\} = -\frac{\Delta f(x)}{f(x).f(x+1)}$$

and hence or otherwise find the value of $\Delta^n\left(\frac{1}{x}\right)$.

3. Find the value of f(12) from the following table correct up to 4 decimal places:

x:	10	15	20	25	30	35
f(x):	35.3	32.4	29.2	26.1	23.2	20.5

4. Using regular falsi method find a real root of $x^3 + 2x - 2 = 0$, correct upto four significant figures.

5. Evaluate

$$\int_1^5 log_{10}\, x\, dx$$

taking 8 sub-intervals, correct upto four decimal places by simpson's 1/3ʳᵈ rule.

6 Compute y(0,2), from the equation

$$\frac{dy}{dx} = x - y, y(0) = 1$$

taking h=0.1, by Runge-kutta method of fourth order, correct to five decimal places.

GROUP - C
(Long Answer Type Questions)
Answer any *three* of the following.   3x15=45

7. (a) Derive Newton's Forward Interpolation Formula.

   (b) The following table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface:

Height (x):	100	150	200	250	300	350	400
Distance (d):	10.66	13.06	15.07	16.84	18.45	19.93	21.30

   Find the value of d when x=390 feet.

8. (a) Show that Newton- Raphson method has second order convergence.

   (b) Solve the following system of equations by Gauss-Jacobi iteration method.

   $8x-y+z=18$

   $2x+5y-2z=3$

   $x+y-3z=-6$

   [7+8]

9. (a) Evaluate $\int_{0}^{1} \dfrac{dx}{1+x^2}$, by using simpson's 1/3 rule taking n=4

   and hence find the value of π.

   (b) Solve by Gauss-seidel iteration method, the system

   $x+y+4z=9$

   $8x-3y+2z=20$

   $4x+11y-z=33$

   [8+7]

10. (a) Apply Euler's method to find the value of y at x=0.02 for the initial value problem

$$dy/dx = y + e^x$$ with y(0)=0, taking h=0.01.

(b) Find the real root of the equation cos x=3x-1 correct to 4 decimal places using successive approximation method.

[8+7]

11. (a) Evaluate

$$\int_0^{\pi/2} \sqrt{1 - 0.162 \, Sin^2\theta} \, d\theta$$

correct upto 4 decimal places by Trapezoidal rule, taking n=10.

(b) Compute the value of y at x=0.01 using Runge-kutta method of order 4 from the differential equation dy/dx=x²+y with y(0)=1 and hence compare your result with the exact solution.

[7+8]

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