LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – MATHEMATICS

FIFTH SEMESTER – NOVEMBER 2018

MT 5409 – NUMERICAL METHODS

Date: 25-10-2018   Dept. No.   Max. : 100 Marks
Time: 01:00-04:00

Part A (Answer ALL questions)   (10 x 2 = 20)

1. Write the condition for convergence in Gauss Seidel method.

2. Solve $x + 2y = 1$ and $3x - 2y = 7$ by Crammer's rule.

3. Find an iterative formula for $x = \sqrt{N}$.

4. State the formula to find the approximations to the root in Regula-Falsi method.

5. Write Newton's backward interpolation formula.

6. Construct the divided difference table for the following data:

x	-4	-1	0	2	5
$f(x)$	1245	33	5	9	1335

7. Write Gauss forward interpolation formula.

8. State Newton's forward difference formulae to find $\dfrac{dy}{dx}$ and $\dfrac{d^2 y}{dx^2}$ at $x = x_0$.

9. Distinguish between Simpson's 1/3rd and 3/8th rule.

10. Define Numerical Integration.

Part B (Answer any FIVE questions)   (5 x 8 = 40)

11. Solve the system of equations $x - 2y + 9z = 8$, $2x - 8y + z = -5$ and $3x + y - z = 3$ using Gauss elimination method.

12. Solve by Gauss-Seidel method, the following system of equations:
    $28x + 4y - z = 32$, $x + 3y + 10z = 24$ and $2x + 17y + 4z = 35$.

13. Find the root of the equation $\sin x = 1 + x^3$ using Newton-Raphson method correct to six decimal places.

14. Find the root of $xe^x = 3$ by regula falsi method correct to three decimal places.

15. The following data give *I*, the indicated HP and *V*, the speed in knots developed by a ship.

V	8	10	12	14	16
I	1000	1900	3250	5400	8950

    Find *I* when *V* = 9, using Newton's forward interpolation formula.

16. Find the value of $\log_{10} 656$ using Newton's divided difference formula for the following data:

$\log_{10} 654 = 2.8156$, $\log_{10} 658 = 2.8182$, $\log_{10} 659 = 2.8189$, $\log_{10} 661 = 2.8202$.

17. Use Stirling's formula to find y_{35} given that $y_{10} = 600$, $y_{20} = 512$, $y_{30} = 439$, $y_{40} = 346$, $y_{50} = 243$.

18. Solve $\dfrac{dy}{dx} = 1 - y$, $y(0) = 0$ in the range $0 \le x \le 0.3$ using Euler's method and modified Euler's method.

Part C (Answer any TWO questions)   **(2 x 20 = 40)**

19. a) Find a root of the equation $x^3 - x - 11 = 0$ correct to four decimals using bisection method.
    b) Find a real root of the equation $\cos x = 3x - 1$ correct to seven decimal places by the method of successive approximation.

                                                                                (12 + 8)

20. a) Using Newton's formula for the data, find the pressure of the steam for the temperatures 142^0 and 175^0.

Temp $C^0(t)$	140	150	160	170	180
Pressure kgf/cm2(P)	3.685	4.854	6.302	8.076	10.225

   b) Use Lagrange's interpolation formula to find the value of y when x = 10 for the following data:

x	5	6	9	11
y	12	13	14	16

                                                                                (12 + 8)

21.   a) Apply Bessel's formula to obtain y_{25} given that $y_{20} = 2854$, $y_{24} = 3162$, $y_{28} = 3544$,

$y_{32} = 3992$.

    b) Use Laplace-Everett's formula to obtain $f(1.15)$ given that $f(1) = 1.000$, $f(1.10) = 1.049$, $f(1.20) = 1.096$, $f(1.30) = 1.140$.

                                                                                (10 + 10)

22. a) Using Taylor's series method, solve $\dfrac{dy}{dx} = x^2 - y$, $y(0) = 1$ at $x = 0.1$ and 0.2.

    b) Using Runge-Kutta methods of fourth order, solve for $y(0.1)$ and $y(0.2)$ given that $y' = xy + y^2$, $y(0) = 1$.

        (10 + 10)

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