LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **MATHEMATICS**

THIRD SEMESTER – APRIL 2017

MT 3965- NUMERICAL ANALYSIS

Date: 26-04-2017 Dept. No. Max. : 100 Marks
09:00-12:00

Answer all the questions.

1. a) Write the steps to be followed in computing the root of the equation using bisection method.

OR

b) Find a real root of the equation $x^3 - 2x - 5 = 0$ using secant method correct to two decimal places.

(5)

c) Find a root of the equation $x^3 + 2x^2 + 10x - 20 = 0$ correct to seven decimal places using Newton Raphson method. (15)

OR

d) Given that the equation $x^{2.2} = 69$ has a root between 5 and 8. Use the method of Regula falsi to determine it. (15)

2. a) If $y_1 = 4, y_3 = 12, y_4 = 19$ and $y_x = 7$, find x. (5)

OR

b) Using Newton's forward difference formula, find the sum $S_n = 1^3 + 2^3 + \cdots + n^3$.

(5)

c) Derive Gauss backward formula for central differences. (15)

OR

d) Find the Lagrange interpolating polynomial of degree 2 approximating the function $y = \ln x$ defined by the following table of values. Hence determine the value of ln 2.7 and estimate the error in the value of y.

x	$y = \ln x$
2	0.69315
2.5	0.91629
3.0	1.09861

(15)

3. a) From the following table, find x, correct to two decimal places, for which y is maximum and find this value of y.

x	y
1.2	0.9320
1.3	0.9636
1.4	0.9855
1.5	0.9975
1.6	0.9996

(5)

OR

b) Derive Simpson's 3/8 rule formula. (5)

c) Calculate the first and second derivative of the function at $x = 1.6$ from the following table and also estimate the errors in the values of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.6$.

x	y
1.0	2.7183
1.2	3.3201
1.4	4.0552
1.6	4.9530
1.8	6.0496
2.0	7.3891
2.2	9.0250

(15)

OR

d) Evaluate $\int_0^1 \frac{dx}{1+x}$ by using (i) Trapezoidal rule and (ii) Simpson's 1/3 rule with $h = 0.5, 0.25$ and 0.125 respectively. (15)

4. a) Solve the system of equations $2x + y + z = 10; 3x + 2y + 3z = 18$ and $x + 4y + 9z = 16$ using Gauss Jordan method.

OR

b) Find the eigen values and eigen vectors of the matrix $A = \begin{pmatrix} 4 & 1 \\ 3 & 2 \end{pmatrix}$. (5)

c) Solve the equations $2x + 3y + z = 9; x + 2y + 3z = 6$ and $3x + y + 2z = 8$ by LU decomposition. (15)

OR

d) Solve by Gauss Siedel iteration method the system of equations $8x - 3y + 2z = 20; 4x + 11y - z = 33$ and $6x + 3y + 12z = 35$. (15)

5. a) Given the differential equation $\frac{dy}{dx} = \frac{x^2}{y^2+1}$ with the initial condition $y = 0$ when $x = 0$, use Picard's method to obtain y for $x = 0.25$ correct to three decimal places.

(5)

OR

b) Solve $\frac{dy}{dx} = 1 - y$, $y(0) = 0$ in the range $0 \le x \le 0.2$ using Euler's method by choosing $h = 0.1$.

(5)

c) Using Runge-Kutta method of fourth-order, solve for $y(0.1), y(0.2)$ and $y(0.3)$ given that $y' = xy + y^2$, where $y = 1$ when $x = 0$. (15)

OR

d) Given the differential equation $y'' - xy' - y = 0$ with the conditions $y(0) = 1$ and $y'(0) = 0$, use Taylor's series method to determine the value of $y(0.1), y(0.2)$ and $y(0.3)$.

(15)

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