

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

M.A./M.Sc. FOURTH SEMESTER EXAMINATION, MAY 2015

SECOND YEAR

MATHEMATICS

Date : 23/05/2015

Time : 11 am – 1 pm

Paper : XVII

Full Marks : 30

[Use a separate Answer book for each Unit]

Unit – I

Answer **any three** questions :

[3×6]

1. Construct the cubic spline interpolant to $f(x) = x^4 + 2x$ with knots $-1, 0, 1$ subject to clamped boundary conditions. Also sketch the cubic spline. [6]
2. Establish Hermite interpolation polynomial and show that it is unique. [6]
3. Deduce Richardson Extrapolation technique for finding an improved integral starting from two approximate integrals. Compute

$$\int_1^{2.2} \ln x \, dx$$

using Richardson extrapolation technique.

[6]

4. Using Romberg integration, calculate

$$\int_0^{1.2} \frac{dx}{1+x} \text{ taking } h = 0.6.$$

Also compute the percentage error.

[6]

5. Define order of convergence of an iterative method for finding a root of an algebraic equation $f(x) = 0$. Show that the order of convergence in Newton Raphson method is 2. [6]

Unit – II

Answer **any two** questions :

[2×6]

6. Obtain second order Runge-Kutta formula for solving the ordinary differential equation

$$\frac{dy}{dx} = f(x, y) \text{ with } y(x_0) = y_0.$$

[6]

7. Discuss LU-Decomposition method for solving the system of linear equations

$$AX = B.$$

[6]

8. a) Write down Fibonacci difference equation and solve it. [2·5]

b) Solve : $u_{x+2} - 7u_{x+1} - 8u_x = x^{(2)} \cdot 2^x$. [3·5]

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