PG – 277

II Semester M.Sc. Examination, June/July 2018
(CBCS, Y2K-17 Scheme)
(2017-18 and Onwards)
MATHEMATICS
M205T : Numerical Analysis – I

Time : 3 Hours Max. Marks : 70

Instructions : *Answer **any five full** questions.*
***All** questions carry **equal** marks.*

PART – A

1. a) Define : i) Floating-point and fixed-point numbers, ii) Relative and round-off errors. 4

   b) Modify the Newton-Raphson method which converges quadratically to find a multiple root of $f(x) = 0$ and whose multiplicity is not known in advance. Hence, find the multiple root of $x^3 - x^2 - x + 1 = 0$ (Perform two iterations with $x_0 = 0.8$). 10

2. a) Describe Bairstow's method of finding the roots of a polynomial equation $f(x) = A_4x^4 + A_3x^3 + A_2x^2 + A_1x + A_0 = 0$ where $A_0 - A_4$ are real constants. 8

   b) Find the root of the equation $\cos x - xe^x = 0$ using the Muller method (Perform two iterations). 6

3. a) Explain LU decomposition method of solving a system of algebraic equation $AX = B$. 7

   b) With suitable examples, explain the term "ill-conditioned". Determine the Euclidean and the maximum absolute row sum norms of the matrix

$$A = \begin{bmatrix} 1 & 7 & -4 \\ 4 & -4 & 9 \\ 12 & -1 & 3 \end{bmatrix}.$$ 7

P.T.O.

4. a) Establish the Gauss-Seidal iteration method of solving a system of equations $AX = B$ in the matrix from. 7

   b) Solve :
   $y\cos(xy) + 1 = 0$, $\sin(xy) + x - y = 0$ using Newton-Raphson method (Perform one iteration by taking $(x_0, y_0) = (1, 2)$). 7

5. a) Obtain Lagrange's interpolating polynomial of degree n in its standard form. 7

   b) Estimate the value of f(0.6) using the Hermite interpolation from the data

x	:	–1	0	1
f(x)	:	1	1	3
f'(x)	:	–5	1	7

   7

6. a) Derive the natural cubic spline interpolation equations for the equally spaced knots. 9

   b) Obtain a rational approximation $R_{2,2}$ for $\cos\sqrt{x}$. 5

7. a) Explain the general problem of numerical integration, and distinguish between Newton-Cotes and Gaussian integration methods. 5

   b) Establish :
   i) Gauss-Chebyshev, and (ii) Gauss-Hermite two and three-point quadrature formulae. 9

8. Evaluate :

   i) $\int_1^2 \frac{dx}{(1+x^3)}$ using Gauss-Legendre two and three-point formulae. 6

   ii) $\int_1^2\int_1^2 \frac{dxdy}{(x+y)}$ using the trapezoidal rule with $h = k = 0.5$ and $h = k = 0.25$. 8