MANIPAL ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

Reg.										

DEPARTMENT OF SCIENCES
II SEMESTER M.Sc (Applied Mathematics and Computing)
END SEMESTER EXAMINATIONS, APRIL/MAY 2019

NUMERICAL ANALYSIS [MAT - 4208]
(REVISED CREDIT SYSTEM-2017)

Time: 3 Hours Date: 02.05.2019 MAX. MARKS: 50

Note: (i) Answer **ALL** questions

(ii) Draw diagrams, and write equations wherever necessary

1A. Using the method of least squares find the straight line that fits the following data. Hence find the least square errors.

x	0.5	1.0	1.5	2.0	2.5	3.0
f(x)	15	17	19	14	10	07

1B. Derive the rate of convergence of Newton – Raphson Method.

1C. Use synthetic division and perform two iterations of the Birge – Vieta method to find the smallest positive root of the polynomial $P_3(x) = 2x^3 - 5x + 1 = 0$. Use the initial approximation $p_0 = 0.5$.

(3 + 3 + 4)

2A. Derive the sufficient condition for the convergence of iteration method.

2B. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$ using LU decomposition method. Take $u_{11} = u_{22} = u_{33} = 1$.

2C. Perform two iterations of the Newton – Raphson method to solve the system of systems $x^2 + xy + y^2 = 7;\ x^3 + y^3 = 9$. Take the initial approximation as $x_0 = 1.5, y_0 = 0.5$.

(3 + 3 + 4)

3A. Perform two iterations of the linear iteration method followed by one iteration of the Aitken Δ^2 method to find the root of the equation

$f(x) = x^3 - 5x + 1 = 0, x_0 = 0.5$.

3B. Using the following data: $\sin(0.1) = 0.09983\ and\ \sin(0.2) = 0.19867$. Find an approximate value of $\sin(0.15)$ and hence obtain the bound on the error at x = 0.15.

3C. Derive Gauss Forward Central Difference Interpolation Formula and obtain its truncation error.

(3 + 3 + 4)

4A. Find the Fourier series approximation to represent $f(x) = x - x^2$ in $-\pi < x < \pi$.

4B. Use Givens method to find the eigenvalues of the tridiagonal matrix $\boldsymbol{A} = \begin{bmatrix} \mathbf{2} & \mathbf{-1} & \mathbf{0} \\ \mathbf{-1} & \mathbf{2} & \mathbf{-1} \\ \mathbf{0} & \mathbf{-1} & \mathbf{2} \end{bmatrix}$

4C. Derive Hermite interpolation formula.

(3 + 3 + 4)

5A. Find the inverse of the given matrix using partition method.

$$\mathbf{A} = \begin{bmatrix} \mathbf{3} & \mathbf{2} & \mathbf{1} \\ \mathbf{2} & \mathbf{3} & \mathbf{2} \\ \mathbf{1} & \mathbf{2} & \mathbf{2} \end{bmatrix}$$

5B. Solve the system of equations using Gauss Seidel Method and find its error format.

$$\begin{aligned} -x_2 + 2x_3 &= 1 \\ 2x_1 - x_2 &= 7 \\ -x_1 + 2x_2 - x_3 &= 1 \end{aligned}$$

Take the initial approximation as $x^{(0)} = 0$ and perform three iterations.

(5 + 5)