

B.E. Computer Science and Engineering Second year First Semester Supplementary Exam. 2018**NUMERICAL METHODS**

Time : 3 hours.

Full Marks : 100

Answer any 5 questions.

1. a) Prove by the method induction

$$\Delta^m y_r = \nabla^m y_{r+m} \quad 5$$

- b) If
- $y = U(x).V(x)$
- then

$$y[x_0, x_1] = U(x_0).V[x_0, x_1] + V(x_1).U[x_0, x_1] \quad 3$$

- c) Use Newton's formula to find the area of a circle of diameter 98 cm from the following area (A) vs. diameter (D) table:

D (cm)	80	85	90	95	100
A (cm ²)	5026	5674	6362	7088	7854

Derive the necessary formula.

12

2. a) Discuss Gauss- Jordan elimination method for matrix inversion. 8
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- b) Find the inverse of the following matrix. 12

$$A = \begin{bmatrix} 4 & 3 & 2 \\ 3 & 2 & 1 \\ 2 & 1 & 4 \end{bmatrix}$$

Also find AA^{-1} .

3. a) Define the terms eigenvalue and eigenvector. 4
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- b) Prove that if a square matrix is transformed into a pure diagonal form, then the diagonal elements represent the eigenvalues of the matrix. 6
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- c) Find all the eigenvalues and eigenvectors of the following matrix by Jacobi's method. 10

$$\begin{bmatrix} 1 & \sqrt{3} & 4 \\ \sqrt{3} & 5 & \sqrt{3} \\ 4 & \sqrt{3} & 1 \end{bmatrix}$$

4. a) Discuss Newton-Raphson method for solution of non-linear equations. 8
 b) Derive the order of convergence for Newton-Raphson method 6
 c) Show that either of the following iteration formula can be used to find \sqrt{N} by Newton-Raphson method.

$$r_{i+1} = r_i * (1 + N/r_i^2)/2 \quad 6$$

5. a) Discuss Divided Difference formula for interpolation. 10
 b) Given the following tabular values:

x	1	2	3	4	6
y	7	17	53	157	857

Find x at y=257 using above method. 10

6. a) Discuss curve fitting by the method of least squares. 10
 b) Discuss Gauss- Seidel iterative method for finding the roots of a set of linear simultaneous equations. Represent the method using matrix notations. 10

7. a) Derive Trapezoidal rule for evaluating the integral

$$\int_a^b f(x) dx \quad 8$$

- b) Calculate the amount of truncation error involved in this method. 6
 c) Evaluate the following integral by the above method.

$$\int_1^2 (1/x) dx . \quad \text{Take } h = 0.2. \quad 6$$

Calculate the percent error from the actual value of the integral.

8. a) Discuss Modified Euler's formula for solution of differential equations. 6
 b) Derive the expression for truncation error of the above method. 4
 c) Solve the following differential equation by **Euler's** method.

$$\frac{dy}{dx} = x^2 + y \quad \text{with } y(0) = 1.0$$

Compute the first 5 steps of the solution with step size $h = 0.1$

Compare the results with those obtained from the exact solution 10

$$y = 3 e^x - x^2 - 2x - 2$$