

Paper Id: **910109**

Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

M.TECH
(SEM I) THEORY EXAMINATION 2019-20
NUMERICAL METHODS AND COMPUTER PROGRAMMING

*Time: 3 Hours**Total Marks: 100***Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 10 = 20**

- a. Define the order (rate) of convergence of an iterative method for finding the root of an equation $f(x) = 0$.
- b. What are the criteria used to terminate an iterative procedure?
- c. What are the assumptions for interpolation?
- d. Write the properties of divided differences?
- e. When does the Gauss elimination method fail?
- f. What is a direct method for solving a linear system of algebraic equation $Ax = b$?
- g. What are the merits and demerits of Lagrange's formula?
- h. What are the disadvantages of the Simpson's 3/8 rule with the Simpson's 1/3 rule?
- i. Differentiate between Initial-value and Boundary-value problems.
- j. Does the power method give the sign of the largest eigen value?

SECTION B**2. Attempt any three of the following: 10 x 3 = 30**

- a. Using the starting value $2(1 + i)$, solve $x^4 + 5x^3 + 20x^2 - 40x + 60 = 0$ by Newton-Raphson method. given that all the roots of the given equation are complex
- b. Given that

$x:$	4	6	8	10	12	14
$f(x):$	3.5460	5.0753	6.4632	7.7217	8.8633	9.8986

 Apply Bessel's formula to find the value of $f(9)$.
- c. Solve the equation by relaxation method

$$10x - 2y + z = 12$$

$$x + 9y - z = 10$$

$$2x - y + 11z = 20$$
- d. Find $\int_0^6 \frac{e^x}{1+x} dx$ approximately using Simpson's $\frac{3}{8}$ th rule on integration.
- e. Find $y(2)$ if $y(x)$ is the solution of $\frac{dy}{dx} = \frac{1}{2}(x + y)$ where $y(0) = 2, y(0.5) = 2.636, y(1) = 3.595, y(1.5) = 4.968$.

SECTION C**3. Attempt any one part of the following: 10 x 1 = 10**

- (a) Find all the roots of the equation $x^4 - 3x + 1 = 0$ by Graeffe's method.
- (b) Using Newton-Raphson method, find the real root of the equation $3x = \cos x + 1$ correct to four decimal places.

4. Attempt any one part of the following: 10 x 1 = 10

(a) The following table gives the scores secured by 100 students in the Numerical Analysis subject:

Range of Score:	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
Number of students:	25	35	22	11	7

Use Newton's forward difference interpolation formula to find:

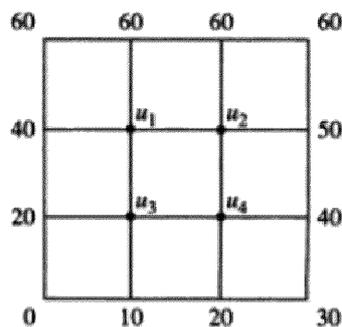
- (i) the number of students who got scores more than 55.
 - (ii) the number of students who secured in the range between 36 and 45.
- (b) $f(x)$ is a polynomial of degree four and given that $f(4) = 270, f(5) = 648, \Delta f(5) = 682, \Delta^3 f(4) = 132$. Find the value of $f(5.8)$ using Gauss's backward formula.

5. Attempt any one part of the following: 10 x 1 = 10

(a) Determine the largest eigen value and the corresponding eigenvector of the following matrix.

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -2 & 2 \end{bmatrix}$$

(b) Using the given boundary value, solve the Laplace equation $\nabla^2 u = 0$ at the nodal points of the square grid shown in figure by using Gauss-Seidel's method.



6. Attempt any one part of the following: 10 x 1 = 10

- (a) Derive the trapezium rule using Lagrange interpolating polynomial.
- (b) The following data gives the velocity of a particle for 8 seconds at an interval of 2 seconds. Find the initial acceleration using the entire data.

Time (sec)	0	2	4	6	8
Velocity (m/sec)	0	172	1304	4356	10288

7. Attempt any one part of the following: 10 x 1 = 10

- (a) Given $y' = x^3 + y, y(0) = 2$, compute $y(0.2), y(0.4)$ and $y(0.6)$ using the Runge-Kutta method of fourth order.
- (b) Given that $\frac{dy}{dx} = \log_{10}(x + y)$ with the initial condition that $y = 1$, when $x = 0$. Find y for $x = 0.2$ and $x = 0.5$, using Euler's modified formula.