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 fine 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 $3x = cosx +$ 1correct to four decimal plaees.

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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.

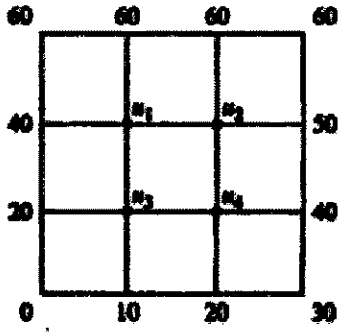
(b) $f(x)$is a polynomial of degree four and given that$f(4) = 270, f(5) = 648, \Delta f(5) = 682, \Delta^3 f(4) = 132$.
Find the value of $f(5.8)$ using Gauss's backward formula.

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.

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