# TEACHING PLAN: Numerical Analysis

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| **SCHOOL: (SOBAS) SCHOOL OF BASIC AND APPLIED SCIENCE** | | **ACADEMIC SESSION: 2023 – 2024** | **FOR STUDENTS' BATCH: B.Sc VI$^{th}$ Sem.** |
| **1** | **Course No.** | MA 303 | |
| **2** | **Course Title** | **Numerical Analysis** | |
| **3** | **Credits** | **2** | |
| **4** | **Learning Hours** | Per week two lectures<br>Total hours; 28 | |
| **5** | **Course Objective** | 1. Gain proficiency in applying finite differences operators and understanding their relations.<br>2. Analyze and compute missing terms in difference tabular values, evaluating the effect of errors.<br>3. Apply Newton's forward and backward interpolation formulae in practical scenarios.<br>4. Explore and comprehend advanced interpolation techniques including Gauss forward, Gauss backward, Sterling, and Bessel formulas | |
| **6** | **Course s Outcome** | After completing the course, the students will be able to:The importance of group in algebra.<br>1. Develop the ability to utilize finite differences operators for interpolation and differentiation tasks effectively.<br>2. Enhance skills in identifying missing terms in difference tabular values and assessing the impact of errors on numerical computations.<br>3. Acquire the capability to utilize Newton's interpolation methods, both forward and backward, to approximate functions accurately.<br>4. Gain insight into advanced interpolation methods, enabling proficient application in various numerical analysis tasks. | |
| **7** | **Outline syllabus:** | | |

| **7.01** | **Paper Code** | **Unit** | **Introduction** | **Page Numbers[1]** | **Lectures** |
|---|---|---|---|---|---|
| **7.02** | **Paper Code. MA 303 Unit I** | (a) | Finite Differences operators and their relations | 1.1 to 1.11 | 1,2 |
| | | (b) | Finding the missing terms and effect of error in a difference tabular value | 2.1 to 2.15 | 3,4 |
| | | (c) | Newton's forward and Newton's backward interpolation formulae | 3.1 to 3.16 | 5,6,7 |
| **7.03** | **Paper Code. MA 303 Unit II** | (a) | Gauss forward, Gauss's backward | **3.17 to 3.30** | **8,9,10** |
| | | (b) | Sterling Formula. | **3.31 to 3.35** | **11,12** |
| | | (c) | Bessel Formula. | **4.1 to 4.50** | **13,14** |
| **7.04** | **Paper Code. MA 303 Unit III** | (a) | Numerical Differentiation, Derivative of a function using interpolation formulae as studied in Sections –I & II. | **5.1 to 5.13** | **15,16** |
| | | (b) | Newton-Cote's Quadrature formula, Trapezoidal rule, | **6.1 to 6.25** | **17,18, 19** |
| | | (c | Simpson's one- third and three-eighth rule, Weddle's rule, Chebychev formula, Gauss Quadrature formula | **6.26 to 6.30** | **20,21** |
| **7.05** | **Paper Code. MA 303 Unit IV** | (a) | Single step methods-Picard's method Euler's method | **7.1 to 7.17** | **22,23** |
| | | (b) | Runge-Kutta Methods , Predictor-corrector method | **7.18 to 7.30** | **24,25, 26** |
| | | (c) | Modified Euler's method | **8.1 to 8.13** | **27,28** |

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| **8** | **Course Evaluation** | |
| **8.1** | **Attendance** | 5% |
| **8.2** | **Homework** | 4 Assignments, 5% |
| **8.3** | **Quizzes** | 2Quizzes, 5% |
| **8.4** | **Projects** | 1 Project, 5% |
| **8.5** | **Presentation** | 1 Presentation, 5% |
| **8.2** | **MTE** | 20% |
| **8.3** | **End-term examination: 60%** | |
| **9** | **Text Books & References** | |
| **9.1** | **Text book** | 1. 1. Numerical Analysis, Jeevansons publication<br>2. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi |
| **9.2** | **References** | 1. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2nd edition)<br>2. VivekSahai and VikasBist : Algebra, NKarosa Publishing House.<br>3. J.B. Gallian: Abstract Algebra, Narosa Publishing House. |
| **9.3** | **Video References** | 1. https://youtu.be/2aLV4N7vd8U<br>2. mathonline.wikidot.com/...structures-fields-rings-and-groups<br>3. users.metu.edu.tr/matmah/Graduate-Algebra-Solution<br>4. www.ring-group.com |

## QUESTION BANK

**[Q.1]** Drive Simson 3/8 rule

**[Q.2]** Drive trapozdial method

**[Q.3]** Write the formula of Netwon forward method

**[Q.4]** Write the formula of Regula Backward method ?

**[Q.5]** Define the formula of Guass elimination method method

**[Q.1]**

Solve the equation by Gauss Elimination method $2x+y+4z = 12$, $4x+11y-z = 33$, $8x-3y+2z = 20$

**[Q.2]**

Solve the equation by LU decomposition

$2x+y+z = 2$ , $x+3y+2z = 2$ , $3x+ y+2z = 2$

**[Q.3]** Given the values:

| x | 5 | 7 | 11 | 13 | 17 |
|---|---|---|---|---|---|
| f (x) | 150 | 392 | 452 | 1366 | 4202 |

Evaluate f(15) using the Lagrange's formula

**[Q.4]** Estimate the value of F(22) from the following data ;

| X | 20 | 25 | 30 | 35 | 40 | 45 |
|---|---|---|---|---|---|---|
| F(X) | 354 | 332 | 291 | 260 | 231 | 204 |

by the Newton interpolation Backward formula.

**[Q.5]** Using the Newton divided difference formula to find the F(X) from the following data , Evaluate f(15) also

| X = | 4 | 5 | 7 | 10 | 11 | 13 |
|---|---|---|---|---|---|---|
| F (X) = | 48 | 100 | 294 | 900 | 1210 | 2028 |

**[Q.6]** Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's 3/8 rule

**[Q.7]** Find the roots of the equation by the Regula Falsi method up to two decimal places $x^3-9x+1 = 0$

Q.9 Using the Euler Modified Method, solve 'y' at x=0.1 from

$\frac{dy}{dx} = x + y + xy$, $y(0) = 1$ take $h = 0.025$