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| **Course No. BS-MATH 233**  | **Title: Engineering Mathematics-III** |
| **Semester: III (New)** | **Credits 3(2+1)** |

**Syllabus**

**Theory:**

**Numerical Techniques** :Finite differences, factorial notation, various difference operators and their relationships, interpolation with equal intervals- Newton’s forward and backward interpolation formula. Bessel's and Stirling’s difference interpolation formulae. Interpolation with unequal intervals-Lagrange’s interpolation formula. Newton's divided difference formula.

**Numerical differentiation and integration**. First and second order derivative by using Newton’s forward and backward interpolation, Maxima and Minima of tabulated function, Numerical Integration: by Trapezoidal rule and by Simpsons rule, applications of Simpson’s rule

**Difference equations and their applications**. Difference equation, Order of difference equation, Solution of linear difference equation, Linear difference equations, Rules for finding complementary function, Rules for finding particular integral and applications

**Numerical solutions of ordinary differential equations:** by Picard’s, Taylor’s series, Euler’s and modified Euler’s method and Runge-Kutta method.

 **Laplace transformation**: Laplace Transform and Inverse Laplace transform and its applications to the solutions of ordinary and simultaneous differential equations.

**Practical**

Applications of Interpolation with equal intervals, Applications of Interpolation with unequal intervals, Applications of Numerical differentiation, Applications : Maxima and Minima, Applications of Numerical integration, Applications of Homogeneous Difference equations, Applications of Non-homogeneous Difference equations, Applications of Numerical solution of ordinary differential equations-Picard’s Method, Applications of Taylors method, Applications of Numerical solution of ordinary differential equations-Euler’s, Applications of Runge-Kutta method, Applications of Laplace transformations, Applications of Inverse Laplace transformation, Applications of Convolution theorem, Application to solution of ordinary differential equations, Application to solution of simultaneous differential equations.

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**Teaching Schedule –Theory with weightages (%)**

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| **Lect. No.** | **Topics to be covered** | **weightages (%)** |
| **Finite Differences and Interpolation** | 17% |
| 1-6 | Finite differences |
| Factorial Notations  |
| Various difference operator and their relationship |
| Newton’s forward and backward interpolation formula |
| Lagrange’s interpolation formulae for unequal intervals |
| **Numerical Differentiation & Integration** |
| 7-12 | First and second order derivative by using Newton’s forward and backward interpolation | 22% |
| Maxima and Minima of tabulated function |
| Numerical Integration: by Trapezoidal rule and by Simpsons rule, applications of Simpson’s rule |
| **Difference Equations and their Applications** |
|  13-17 | Difference equation, Order of difference equation, Solution of linear difference equation | 15% |
| Linear difference equations |
| Rules for finding complementary function |
| Rules for finding particular integral and applications |
| **Numerical Solution of Ordinary Differential Equations** |
| 18-20 | Picard’s method | 8% |
| Taylor’s series method |
| Euler’s method |
| **Laplace Transforms** |
| 21-33 | Definition, Laplace Transform of elementary functions | 38% |
| Properties of Laplace Transforms |
| Laplace Transform of periodic function |
| Laplace Transform of derivatives |
| Laplace Transform of an integral |
| Laplace Transform of function multiplied by tn |
| Laplace Transform of function divided by t |
| Inverse Laplace Transform |
| Convolution Theorem(Without Proof) |
| Applications of LT. Solving ordinary differential equations |
| Solving Simultaneous differential equations using Laplace Transformation. |

**Practical Exercise**

1. Applications of Interpolation with equal intervals
2. Applications of Interpolation with unequal intervals
3. Applications of Numerical differentiation
4. Applications : Maxima and Minima
5. Applications of Numerical integration
6. Applications of Homogeneous Difference equations
7. Applications of Non-homogeneous Difference equations
8. Applications of Numerical solution of ordinary differential equations-Picard’s Method
9. Applications of Taylors method
10. Applications of Numerical solution of ordinary differential equations-Euler’s
11. Applications of Runge-Kutta method
12. Applications of Laplace transformations
13. Applications of Inverse Laplace transformation
14. Applications of Convolution theorem
15. Application to solution of ordinary differential equations.
16. Application to solution of simultaneous differential equations

**Suggested Reading**

**Text Book**

1. Dr. Shinde K. J. *et.al.* A text book of Agricultural Engineering Mathematics-III

**Reference Book**

1. Grewal B S. 2015. Higher Engineering Mathematics. Khanna Publishers Delhi.(43rd Edition)