



**Pre-requisites:** A basic course on differentiation and integration of function.

**Contents:**

**Unit-I**

**Laplace Transforms:** Definition and Properties. Laplace transform of elementary functions. Laplace transforms of Periodic functions and unit-step function problems.

**Inverse Laplace Transforms:** Inverse Laplace transform - problems, Convolution theorem (without proof) to find the inverse Laplace transform and problems, solution of linear differential equations using Laplace transform. **8 Hrs.**

**Unit-II**

**Fourier Series:** Periodic functions, Dirichlet's condition. Fourier series of periodic functions of period  $2\pi$  and arbitrary period. Half-range Fourier series. Practical harmonic analysis, examples from engineering field. **8 Hrs.**

**Unit-III**

**Fourier Transforms:** Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Simple problems.

**Z-Transforms and Difference Equations:** Z-transform- definition, Standard Z-transforms, Damping and shifting rules, Initial value and Final value theorems (without proof) with problems. Inverse Z-transform. Simple problems. Difference equations-basic definition. Application of Z-transform to solve Difference equation. **8 Hrs.**

**Unit-IV**

**Numerical Solutions of Ordinary Differential Equations (ODE's):** Numerical solution of ODE's of first order and first degree-Taylor's series method, Modified Euler's method. Runge-Kutta method of fourth order, Milne's predictor and corrector method (No derivations of formulae). Problems. **7 Hrs.**

**Unit-V**

**Numerical Solution of Second Order ODE's:** Runge-Kutta method and Milne's predictor and Corrector method. (No derivations of formulae).

**Calculus of Variations:** Variation of function and functional, variational problems, Euler's equation (without proof), Geodesics (plane), hanging chain problems.

**8 Hrs**

**Reference Books:**

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44<sup>th</sup> edition, 2017.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10<sup>th</sup> edition (Reprint), 2016.
3. Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3<sup>rd</sup> edition, 2016.