

**Module 1**

**Chapter 1 : Laplace Transform 1-1 to 1-34**

**Syllabus :**

- 1.1 : Definition of Laplace transform, Condition of Existence of Laplace transform.
- 1.2 : Laplace Transform (L) of standard functions like  $e^{at}$ ,  $\sin(at)$ ,  $\cos(at)$ ,  $\sinh(at)$ ,  $\cosh(at)$  and  $t^n, n \geq 0$ .
- 1.3 : Properties of Laplace Transform : Linearity, First Shifting Theorem, Second Shifting Theorem, Change of scale property, Multiplication by  $t$ , Division by  $t$ , Laplace Transform of derivatives and integrals (Properties without proof).
- 1.4 : Evaluation of real improper integrals by using Laplace Transformation.

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1.2.8	Laplace Transform of Integral.....	1-24
1.3	Evaluation of Integral using Laplace Transform.....	1-28

**Module 2**

**Chapter 2 : Inverse Laplace Transform 2-1 to 2-16**

**Syllabus :**

- 2.1 : Definition of Inverse Laplace Transform, Linearity property, Inverse Laplace Transform of standard functions, Inverse Laplace transform using derivatives.
- 2.2 : Partial fractions method to find Inverse Laplace transform.
- 2.3 : Inverse Laplace transform using Convolution theorem (without proof).

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2.1.1	Definition of Inverse Laplace Transform.....	2-1
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2.4	Evaluation of Inverse Laplace Transform using Derivative : ( $\log, \tan^{-1}, \cot^{-1}, \tan^{-1}$ ).....	2-10

**Module 3**

**Chapter 3 : Fourier Series 3-1 to 3-54**

**Syllabus :**

- 3.1 : Dirichlet's conditions, Definition of Fourier series and Parseval's Identity (without proof).
- 3.2 : Fourier series of periodic function with period  $2\pi$  and  $2l$ .
- 3.3 : Fourier series of even and odd functions.
- 3.4 : Half range sine and cosine series.

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**Module 4**

**Chapter 4 : Complex Variables 4-1 to 4-31**

**Syllabus :**

- 4.1 : Function  $f(z)$  of complex variable, Limit, Continuity and Differentiability of  $f(z)$ , Analytic function : Necessary and sufficient conditions for  $f(z)$  to be analytic (without proof).

4.2 : Cauchy-Riemann equations in Cartesian coordinates (without proof).  
 4.3 : Milne-Thomson method : Determine analytic function  $f(z)$  when real part ( $u$ ), imaginary part ( $v$ ) or its combination ( $u + v / u - v$ ) is given.  
 4.4 : Harmonic function, Harmonic conjugate and Orthogonal trajectories.

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 4.2 Cauchy-Riemann (C-R) Equations in Cartesian Form .....4-2  
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 4.5 Finding Harmonic Conjugate .....4-22  
 4.6 Orthogonal Trajectories .....4-27

**Module 5**

**Chapter 5 : Statistical Techniques 5-1 to 5-40**

**Syllabus :**  
 5.1 : Karl Pearson's coefficient of correlation ( $r$ ).  
 5.2 : Spearman's Rank correlation coefficient ( $R$ ) (with repeated and non-repeated ranks).  
 5.3 : Lines of regression.  
 5.4 : Fitting of first-degree and second-degree curves.

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 5.2 Scatter Diagram .....5-2  
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**Module 6**

**Chapter 6 : Probability 6-1 to 6-34**

**Syllabus :**  
 6.1 : Definition and basics of probability, Conditional probability.  
 6.2 : Total Probability theorem and Bays' theorem.  
 6.3 : Discrete and continuous random variable with probability distribution and probability density function.  
 6.4 : Mathematical Expectation, Variance and covariance.  
 6.5 : Moment generating function, Raw and central moments up to fourth order.

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