

# Government PG College, Ambala Cantt

## Course File (Session 2023-2024)(EVEN SEMESTER)

Name of professor: Deepak Kumar

Class: B.Sc II /4<sup>th</sup> semester/computer science + Non medical

**SUBJECT NAME: BM -242 : Special Functions And Integral Transforms**

Time : 3 Hours

B.Sc.

B.A.

Theory : 40

Theory : 26

Sessional : 10

Sessional : 7

**Note:** The examiner is requested to set **nine questions** in all, selecting two questions from each section and one compulsory question consisting of five or six parts distributed over all the four sections. Candidates are required to **attempt five questions** in all, selecting **at least one question** from each section and the compulsory question.

### SECTION-I

Series solution of differential equations – Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions.

### SECTION-II

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orthogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

### SECTION-III

Laplace Transforms – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.

### SECTION-IV

Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms.

### Books Recommended:

1. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999

2. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.

3. I.N. Sneddon : Special Functions on mathematics, Physics & Chemistry.

4. W.W. Bell : Special Functions for Scientists & Engineers.

5. I.N. Sneddon: the use of integral transform, McGraw Hill, 1972 6. Murray R. Spiegel: Laplace transform, Schaum's Series

### Lesson Plan

Scheduled dates	Topic to be covered
1-15 January	Series solution of differential equations – Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution
16-31 January	Bessel functions and their properties Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions.
1-15 February	Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orthogonality of Legendre and Hermite polynomials.
16-29 February	Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.
1-15 March	Laplace Transforms – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem,
16-31 March	Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.
1-15 April	Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms
16-27 April	Test/assignment/Revision