**MA5703 Mathematical Methods-I**

**Transform Calculus:** Periodic functions, Fourier series representation of a function, half range series, sine and cosine series, Fourier integral formula, Parseval’s identity. Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting and time shifting properties. Self-reciprocity of Fourier Transform, convolution theorem. Applications to boundary value problems. Definition of Laplace Transform, linearity property, conditions for existence of Laplace Transform. First and second shifting properties, Laplace Transform

of derivatives and integrals, unit step functions, Dirac delta-function, error function. Differentiation and integration of transforms, convolution theorem, inversion, periodic functions. Evaluation of integrals by Laplace Transform. Solution of initial and boundary value problems.

**Series Solution and Special Functions:** Power series solution of a differential equation about an ordinary point, solution about a regular singular point (Frobenious method). Legendre equation and Legendre polynomial, Generating function for Legendre polynomial, Recurrence relations between Legendre polynomials, Rodrigue’s formula, Orthogonality of Legendre polynomial, Associated Legendre equation and Legendre function, Bessel

equation and its solution, Bessel functions, Modified Bessel function, Generating function for Bessel function, Recurrence relations between Bessel functions, Orthogonality of Bessel functions. Hypergeometric equation and functions, Properties of hypergeometric functions. Two-point boundary-value problems, Green's functions, Construction of Green's functions, Nonhomogeneous boundary conditions, Sturm-Liouville Systems, Eigen values and Eigen functions, Eigen function expansions and completeness.

**References:**

1. G. N. Watson, A Treatise on the Theory of Bessel Functions, Cambridge University Press, 1944.

2. G. F. Roach, Green's Functions, Cambridge University Press, 1995.

3. A. D. Poularikas, The Transforms and Applications Handbook, CRC Press, 1996.

4. L. Debnath and D.D. Bhatta, Integral Transforms and Their Applications, Chapman and Hall/CRC, 2011.

5. J. W. Brown and R. Churchill, Fourier Series and Boundary Value Problems, McGraw Hill, 1993.

6. F.G Tricomi, Integral Equations, Dover Publications Inc. New York, 1985.