

Course No	Course Name	L-T-P-Credits
<b>MA 201</b>	<b>Integral Transforms and PDEs</b>	<b>3-1-0: 4</b>

Prerequisite: nil

**Course Objectives:** The objective of this course is to introduce the fundamental concepts of Fourier series, Fourier transforms and Laplace transforms and their applications to differential equations.

**Course Outcomes:** After successful completion of the course, student will be able to:

1. Find Fourier series, Fourier cosine and sine series for a given periodic function.
2. Determine Fourier and inverse Fourier transform of a function and understand the fundamental properties.
3. Determine Laplace transform of a function and understand the fundamental properties.
4. Apply Fourier and Laplace transform in solving ODEs and PDEs.
5. Determine series solution for Legendre's and Bessel's equations
6. Classify the second order PDEs and obtain the solution of heat, wave and Laplace equations by using Fourier series.

### SYLLABUS

Module	Contents	Hours
I	<b>Fourier Series:</b> Periodic functions, trigonometric series, Fourier series of a function with arbitrary period with special emphasis on functions of period $2\pi$ , Fourier series of even and odd functions, half-range Fourier series.	08
II	<b>Integral Transforms:</b> Fourier Transform: Fourier integral theorem, Fourier sine and cosine integrals, complex form of Fourier integral, Fourier transform of derivative of a function, applications of Fourier transform in boundary value problems; Laplace Transform: Laplace transform of a function, existence theorem, Laplace transform of derivatives and integrals, inverse Laplace transform, convolution theorem, use of Laplace transform in solving differential equations.	15
III	<b>Series Solution to ODE:</b> Legendre's and Bessel's differential equations.	05
IV	<b>Partial Differential Equations</b> Introduction to partial differential equations, separation of variable	08

method; Solution of second order partial differential equations in mathematical physics (heat, wave and Laplace equations) with standard boundary conditions using Fourier series.

**Essential Readings:**

1. E. Kreyszig, “*Advanced Engineering Mathematics*”, John Wiley & Sons, 10<sup>th</sup> edition 2015,
2. R. K. Jain and S. R. K. Iyengar, “*Advanced Engineering Mathematics*”, Narosa Publishing House, 5<sup>th</sup> edition, 2016.

**Supplementary Readings:**

1. P. Dyke, “*An Introduction to Laplace Transforms and Fourier Series*”, Springer Undergraduate Mathematics Series, 2005.