Winter School: January – February 2023

Name of course: Introduction and Applications of Laplace Transform
Course Code: MA0056
Name of Instructor: Dr Alok Bhargava and Dr Garima Agarwal
Session: Jan – Feb 2023
Language of instruction: English
Number of contact hours: 34
Credit awarded: 03

Objective of course: The goal of this course is for students to gain the knowledge of the mathematical transformation tool Laplace Transform and acquire the proficiency to apply in the relevant applications and computations. This transformation is highly useful in the calculations of various engineering problems of different domains where we confront with various differential equations.

Course Level Learning Objectives:
Upon successful completion of this course, students will be able to:
- Describe the concept of Laplace Transform and its properties.
- Describe the concept of Inverse Laplace Transform and its properties.
- Apply the transformation to solve the problems.

Syllabus
Laplace transform: Introduction, Existence theorem for Laplace transform; Laplace transform of some elementary functions. **Properties of Laplace transform**: Linearity, First and second shifting, Change of scale, Laplace transforms of derivatives and integrals, multiplication of a function with powers of variable, division of a function with powers of variable, Initial and final value theorems. **Laplace transform of some special functions** – Periodic function, Sine integral, Cosine integral, Exponential integral, Impulse or Dirac delta function, Error Functions. **Inverse Laplace transform:** Introduction, Properties: Linearity, change of scale, Shifting theorems, Derivatives and integrals, Division, and multiplication with powers of the Laplacian parameter, Convolution theorem. **Application of Laplace Transforms**: Evaluation of Integrals, Solution of ordinary differential equations and partial differential equations using Laplace transform.

Organization of course

Total contact hrs 36		
First week:	8 hrs (classes)	2 hrs (self-study/project)
Second week:	8 hrs (classes)	1hr (Sessional Exam / assessment/discussion)
Third week:	8 hrs (classes)	1hr (Sessional Exam / assessment/discussion)
Fourth week	4 hrs (classes)	2 hrs (End term exam)

Mode of lectures: hybrid lectures/online videos/case study/ discussion/ workshop/ hands-on practice.

Course Plan

Lecture no.	Topic	Lecture mode	Instructor
L: 1-8	Laplace transform and its properties.	Online/hybrid Lecture and discussion	Dr. Alok Bhargava Dr. Garima Agarwal
L: 9-13	Laplace transforms of some special functions.	Online/hybrid Lecture and discussion	Dr. Alok Bhargava Dr. Garima Agarwal
L: 14-21	Inverse Laplace transform	Online/hybrid Lecture and discussion	Dr. Alok Bhargava Dr. Garima Agarwal
L: 22-28	Application of Laplace transform	Online/hybrid Lecture and discussion	Dr. Alok Bhargava Dr. Garima Agarwal

Brief profiles of the instructors:

Dr Alok Bhargava
He earned his Ph.D. from Poornima University, Jaipur (India). He has more than 22 years of teaching, research, and administrative experience. Presently he is associated with Manipal University Jaipur, India as an Assistant Professor in Mathematics and Statistics department. His specialization includes Special Functions, Fractional Calculus and Integral Transforms and their applications.

Dr Garima Agarwal
She did her Ph.D from Jai Narayan Vyas University in 2013. Her research interest is fractional calculus, special functions, and integral transforms. She has more than 10 years teaching experience. Presently she is working as assistant professor in the Department of Mathematics and Statistics in Manipal university Jaipur.