SYLLABUS

24MA201 - COMPLEX VARIABLES AND TRANSFORMS

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UNIT I – Complex Differentiation	**[12 hours]**
Function of a complex variable – Analytic functions – Necessary conditions and sufficient conditions (excluding proof) – Cauchy – Riemann equations — Properties of analytic function – Harmonic conjugate – Construction of Analytic functions - Conformal mapping: w = z+a, az, 1/z, and bilinear transformation.	

UNIT II – Complex Integration	**[12 hours]**
Statement and application of Cauchy's integral theorem and integral formula – Taylor and Laurent expansions – Isolated singularities – Residues - Cauchy's residue theorem. Applications: Contour integration over unit circle and semicircular contours (excluding poles on axis).	

UNIT III – Laplace Transforms	**[12 hours]**
Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorem – Inverse Laplace Transform – Convolution Theorem (Statement only) – Solution of linear second order Ordinary differential equations with constant coefficients using Laplace transforms.	

UNIT IV – Fourier Series and Fourier Transforms	**[12 hours]**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series – Harmonic analysis - Statement of Fourier integral theorem – Fourier transform pair – Parseval's identity.	

UNIT V – Partial Differential Equation	**[12 hours]**
Formation of partial differential equations - Classification of partial differential equations - Solutions of one dimensional wave equation, One dimensional heat equation (excluding insulated ends) – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Construct analytic functions and use their conformal mapping property in Engineering problems.	K3
CO2	Solve real and complex integrals using the Cauchy's integral formula and residue theorem.	K3
CO3	Apply Laplace transforms techniques in system modelling, digital signal processing, process control, solving boundary value problems	K3
CO4	Apply Fourier series to solve the steady state two-dimensional heat equation in cartesian coordinates.	K3
CO5	Apply the effective mathematical tools for solutions of partial differential equations that model physical phenomena and engineering problems.	K3

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012
4. Kandasamy. P., Thilagavathy. K, and Gunavathy. K, Engineering Mathematics Volume I & II, S. Chand & Co, New Delhi, 2005.Reference Books:

Equivalent NPTEL/SWAYAM Courses

S. No.	Course Title	Course Instructor	Host Institute
1.	Partial Differential Equations	Prof. Sivaji Ganesh	IIT Bombay
2.	Introduction to Fourier Analysis	Prof. Parasar Mohanty	IIT Kanpur
3.	Complex Analysis	Prof. Pranav Haridas	IIT Madras

Web Links and Video Lectures (E-Resources):

1. Analytic Functions, C-R Equations: https://www.nptelvideos.com/lecture.php?id=13416
2. Laplace Transform and its Existence: https://www.nptelvideos.com/lecture.php?id=13433
3. Taylor's, Laurent Series of f(z) and Singularities: https://www.nptelvideos.com/lecture.php?id=13431
4. Applications of Fourier Transform to PDEs: https://www.nptelvideos.com/lecture.php?id=13442