ENGINEERING MATHEMATICS II

PROF. JITENDRA KUMAR
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PRE-REQUISITES : Engineering Mathematics - I

INTENDED AUDIENCE : All branches of science and engineering.

COURSE OUTLINE :
This course is about the basic mathematics that is fundamental and essential component in all streams of undergraduate studies in sciences and engineering. The course consists of topics in complex analysis,numerical analysis, vector calculus and transform techniques with applications to various engineering problems. This course will cover the following main topics.Function of complex variables. Analytic functions. Line integrals in complex plane. Cauchy's integral theorem, Derivatives of analytic functions. Power series, radius of convergence. Taylor's and Laurent's series, zeros and singularities, residue theorem.Iterative method for solution of system of linear equations. Finite differences, interpolation. Numerical integration. Solution of algebraic and transcendental equations.Vector and scalar fields. Limit, continuity, differentiability of vector functions. Directional derivative, gradient, curl, divergence. Line and surface integrals, Green, Gauss and Stokes theorem.Laplace transform and its properties. Laplace Transform of specialfunction. Convolution theorem. Evaluation of integrals by LaplaceTransform. Solution of initial and boundary value problems.Fourier series representation of a function. Fourier sine and cosinetransforms. Fourier Transform. Properties of Fourier Transform.Applications to boundary value problems.

ABOUT INSTRUCTOR :

Prof. Jitendra Kumar is an Associate Professor at the Department of Mathematics, IIT Kharagpur. He completed his M.Sc. in Industrial Mathematics from IIT Roorkee and Technical University of Kaiserslautern, Germany in 2001 and 2003, respectively. He received his PhD degree in 2006 from Otto-von-Guericke University Magdeburg, Germany. He was Research Associate at the Institute for Analysis and Numerical Mathematics, Otto-von-Guericke University Magdeburg, Germany from 2006 to 2009. Dr. Kumar is the recipient of several recognized awards and fellowships, including Alexander von Humboldt fellowship, DAAD & DGF scholarships. His research interests include Numerical solutions of integro-differential equations, numerical analysis and modelling and simulations of problem in particulate systems.

COURSE PLAN :

Week 1**:** Vector and scalar fields. Limit, continuity, differentiability of vector functions. Directional derivative, gradient, curl, divergence

Week 2**:** Line and surface integrals, Green, Gauss and Stokes theorem.

Week 3**:** Function of complex variables and their properties including continuity and differentiability. Analytic functions and CR equations, Line integrals in complex plane.

Week 4**:** Cauchy's integral theorem,Power series, radius of convergence. Taylor's and Laurent's series, zeros and singularities,residue theorem

Week 5**:** Iterative method for solution of system of linear equations. Finite differences, interpolation.

Week 6**:** Numerical integration. Solution of algebraic and transcendental equations.

Week 7**:** Laplace transform and its properties. Laplace Transform of special function.

Week 8**:** Convolution theorem. Evaluation of integrals by Laplace Transform. Solution of initial and boundary value problems.

Week 9**:** Fourier series and its convergence.

Week 10**:** Fourier integral representation

Week 11**:** Fourier sine and cosine transforms. Fourier Transform. Properties of Fourier Transform.

Week 12**:** Applications of Fourier series to boundary value problems.