PKU Globex Julmester

Applied Analysis for Engineering Sciences (3 Credits)

工程科学应用分析

(Course Code: 00333148)

Instructor	Emily TIAN, Wright State University (mei.tian@wright.edu) TANG Shaoqiang, Peking University (maotang@pku.edu.cn)	
Synopsis	The objectives of this course include: to show mathematical methods that are widely used in engineering sciences; to explore linear and nonlinear differential equations; to help bridge the gap between mathematical tools and physical understandings.	
Audience	Year 2+ Undergraduate and Graduate Students Prerequisites: Calculus (Single variate, and multi-variate), Linear Algebra.	
Classroom	TBA	
Schedule	Class: 9-12 AM, M-F, June 30 – July 18, 2025	Total Contact Hours: 45
Topics	1. Recap: how to solve Ordinary Differential Equations (ODEs) exactly? a) Linear ODEs with constant coefficients b) General ODEs: inhomogeneous, variable coefficients, power series and perturbation method 2. Qualitative theory of ODEs a) Plane analysis for second order ODE b) Stability analysis via Lyapunov function c) Bifurcation and chaos 3. Solving PDEs: linear and nonlinear a) Laplace equation: separating variables, Green's function (* spherical and cylindrical coordinates) b) Heat equation: Fourier transform, Green's function c) Wave equation: characteristic method, D'Alembert's principle d) Nonlinear equations: Burgers' equation via Cole-Hopf transform, shock and rarefaction waves in inviscid Burgers' equation (* traveling waves)	
Grading	Homework Assignments 40% Exam (open-book) 60% Total 100%	