

*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 (emilytianedu@gmail.com) 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 <u>Prerequisites:</u> Calculus (Single variate, and multi-variate), Linear Algebra.							
Classroom	TBA							
Schedule	<u>Class:</u> 9-12 AM, M-F, July 6 – July 24, 2026	<u>Total Contact Hours:</u> 45						
Topics	<ol style="list-style-type: none"><li>1. Recap: how to solve Ordinary Differential Equations (ODEs) exactly?<ol style="list-style-type: none"><li>a) Linear ODEs with constant coefficients</li><li>b) General ODEs: inhomogeneous, variable coefficients, power series and perturbation method</li></ol></li><li>2. Qualitative theory of ODEs<ol style="list-style-type: none"><li>a) Plane analysis for second order ODE</li><li>b) Stability analysis via Lyapunov function</li><li>c) Bifurcation and chaos</li></ol></li><li>3. Solving PDEs: linear and nonlinear<ol style="list-style-type: none"><li>a) Laplace equation: separating variables, Green's function (* spherical and cylindrical coordinates)</li><li>b) Heat equation: Fourier transform, Green's function</li><li>c) Wave equation: characteristic method, D'Alembert's principle</li><li>d) Nonlinear equations: Burgers' equation via Cole-Hopf transform, shock and rarefaction waves in inviscid Burgers' equation (* traveling waves)</li></ol></li></ol>							
Grading	<table><tr><td>Homework Assignments</td><td>40%</td></tr><tr><td>Exam (open-book)</td><td>60%</td></tr><tr><td>Total</td><td>100%</td></tr></table>		Homework Assignments	40%	Exam (open-book)	60%	Total	100%
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**Emily M. TIAN**

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Dr. Tian is an associate professor at Wright State University located in Dayton, Ohio. She has been teaching mathematical methods in applied fields for over two decades, after receiving her PhD in applied math from Washington State University. Her expertise is finding the basic building blocks in nonlinear dynamic systems. Dr. Tian is passionate about inspiring students to listen to the stories spoken by the formulas.

**TANG Shaoqiang**

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Department of Mechanics

School of Mechanics and Engineering Science, Peking University

Dr. Tang is a Boya Distinguished professor at School of Mechanics and Engineering Science, Peking University. He earned PhD in Applied Mathematics, HKUST. His research areas focus on computational mechanics and applied mathematics. He teaches both undergraduate and graduate courses such as Calculus, Linear Algebra, Ordinary Differential Equations, Partial Differential Equations, Fundamentals of Machine Learning, Applied Analysis, Scientific Computing, Numerical Methods, Multiscale Algorithms etc. He was honored the Teacher of Excellence Award, and Hall of Fame in College Teaching by Beijing municipal government.