

Engineering Math: Differential Equations

CREDIT	3	INSTRUCTOR	Dr. Woong Lim
OFFICE	Education Science Building Office 309	OFFICE HOURS	By appointment
TIME	09:00 ~ 10:40 am	CLASSROOM LOCATION	Online via Zoom
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[COURSE INFORMATION]

COURSE DESCRIPTION & GOALS	<p>This course covers first- and second-order ordinary differential equations and their applications and modeling. Students begin with topics such as direction fields, separable ODEs, integrating factors, Bernoulli equations, and Euler-Cauchy equations. Then students learn to solve non-homogeneous ODEs. Additional topics include power series method, Legendre Polynomials, Frobenius method, and Bessel functions. There will be a brief visit to linear algebra topics so that students can handle matrix eigenvalue problems and basics of linear systems. Then students will return in order to solve the system of ODEs. Lastly, students will learn Laplace transforms with related topics, such as inverse, s-shifting, derivatives, integrals, Heaviside function, t-shifting, convolution, integral equations, and solving system of ODEs.</p>
PREREQUISITE	Calculus and a basic knowledge of linear algebra
COURSE REQUIREMENTS	<p><u>Online instruction via Zoom including real time lectures, video clips, notes, Q&As.</u> Access to the Internet to attend zoom meetings (real time), watch recorded video clips, and download lecture notes and learning material on the LearnUs platform. Graphing calculators are allowed.</p>
GRADING POLICY	Exam 1 (30%) + Exam 2 (30%) + Quiz (1, 2) (15% each) + Attendance/Participation (10%)
TEXTS & NOTES	Course text: <i>Advanced Engineering Mathematics</i> by Erwin Kreyszig, 10th ed, ISBN 9780470646137 (Lecture notes and exercise problems may be provided.)
INSTRUCTOR'S PROFILE	<p>Dr. Lim is an associate professor in Graduate School of Education at Yonsei University. Dr. Lim studied applied mathematics at Northwestern University. Later he obtained a master's in mathematics and a doctorate in mathematics education from University of Houston. Prior to coming to Yonsei, he taught at Kennesaw State University and the University of New Mexico. For last a couple of years he has taught Engineering Mathematics 1, 3 and 4 here at Yonsei.</p>

[WEEKLY SCHEDULE]

WEEK (PERIOD)	WEEKLY TOPIC & CONTENTS	COURSE MATERIAL & ASSIGNMENTS	NOTES
1	<ul style="list-style-type: none"> • Introduction • Direction fields • First-order separable ODEs • Exact ODEs • Integrating factors • Bernoulli Equation • Homogeneous linear ODEs of second-order • Homogeneous linear ODEs w/ constant coefficients 		
2	<ul style="list-style-type: none"> • Euler-Cauchy equations • Wronskian • Non-homogeneous ODEs • Solution by variation of parameters • Power series method 		
3	<ul style="list-style-type: none"> • Legendre's equation • Legendre's polynomials • Frobenius method • Bessel functions 		Exam 1
4	<ul style="list-style-type: none"> • Linear algebra topics: matrices, vectors, linear systems of equations, linear transformation, matrix eigenvalues, eigenvectors • System of ODEs • Phase plane method • Critical points (nodes, spirals, center, saddle), stability 		
5	<ul style="list-style-type: none"> • Laplace transform - inverse, linearity • s-shifting • Transform of derivatives and integrals • Heaviside function • t-shifting 		
6	<ul style="list-style-type: none"> • Convolution • Integral equations • Differentiation and integration of transforms • System of ODEs 		Exam 2