Course:		**Engineering Analysis (I) – 0903201 (3 Cr. – Required Course)**			
Instructor:		Eng. Noor awad			
		Telephone: 06/5355000 ext 22860, Email: n.awad@ju.edu.jo			
		Office Hours: Will be posted soon			
Course website:		https://elearning.ju.edu.jo/			
Catalog description:		First-order ordinary differential equations. Separable, exact and linear ordinary differential equations. Second-order ordinary differential equations. Homogeneous and non-homogeneous ordinary differential equations. General and particular solution. Euler-Cauchy equation. Higher-order linear ordinary differential equations. Linear systems of equations and their solution. Determinants, eigenvalues and eigenvectors. Systems of differential equations. Solving homogeneous and non-homogeneous system of differential equations. Series solutions of differential equations. Orthogonal functions. Laplace transform and its inverse. Solving initial value problem using Laplace transform. Properties of Laplace transform. Solving system of ordinary differential equations using Laplace transform.			
Prerequisites by course:		**Mt**	**0301201**	Calculus III	(pre- or co-requisite)
Prerequisites by topic:		Students are assumed to have a background in the following topics: • Single-variable calculus (functions, limits, differentiation and integration). • Sequences and series. • Knowledge of vectors and basic properties of vector valued functions.			
Textbook:		**Fundamentals of Differential Equations and Boundary Value Problems by R. Kent Nagle, Edward B. Saff, Arthur David Snider, Pearson Education, 6th edition 2012**			
References:		1.	Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, 10th Edition, 2011.		
		2.	Advanced Engineering Mathematics by Peter V. O'Neil, Cengage Learning, 8th Edition, 2017.		
		3.	Advanced Engineering Mathematics by K.A. Stroud and Dexter Booth, Red Globe Press, 6th Edition, 2020.		
		4.	Schaum's Outline of Differential Equations by Richard Bronson and Gabriel Costa, McGraw-Hill Education, 4th edition, 2014.		
		5.	Schaum's Outline of Advanced Mathematics for Engineers and Scientists by Murray Spiegel, McGraw-Hill Education, 1st Edition, 2009.		
		6.	The Differential Equations Problem Solver by David R. Arterburn, Research and Education Association, 1st Edition, 2008.		
		7.	Differential Equations and Linear Algebra by Gilbert Strang, Wellesley-Cambridge, 1st Edition, 2014.		
		8.	Ordinary Differential Equations: An Introduction to the Fundamentals by Kenneth B. Howell, CRC Press, 1st Edition, 2015.		
Schedule:		16 Weeks, 42 lectures (50 minutes each) plus exams.			
Course goals:		The overall objective is to introduce the student to the fundamentals of ordinary differential equations (ODEs) and their solution techniques. Using series solutions and Laplace transforms to solve ODEs are emphasized. The student is also trained into how real-life problems can be modeled using ODEs.			

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):		
Upon successful completion of this course, a student will:		[SO]
1.	Know the basic concepts of ordinary differential equations.	[1]
2.	Be able to calculate the Laplace and inverse Laplace transform of a given function.	[1]
3.	Be able to select the proper procedure to solve a given ordinary differential equation.	[1]
4.	Be able to solve a system of linear ordinary differential equations.	[1]
5.	Be able to write down a set of ordinary differential equations to model a given real-life system.	[1]

Course topics:		Hrs
1.	First-order ordinary differential equations: Definitions and classification, ordinary equations, separable equations, linear equations, non-linear equations, exact equations, homogeneous equations, non-homogenous equations, initial-value and boundary-value problems, differential equations as mathematical models.	9
2.	Basics of linear systems of algebraic equations: Eigen values and eigen vectors, matrices, determinants, Gauss elimination method, Cramer's Rule.	3
3.	Second-order ordinary differential equations: Linear independence, homogeneous linear equations with constant coefficients, exponential solution, characteristic equation, Euler-Cauchy equation, undetermined coefficients, general solution, particular solution, reduction of order, non-homogeneous ordinary differential equations, variation of parameters.	9
4.	Higher-order linear ordinary differential equations: System of homogeneous linear differential equations, linear independence, existence and uniqueness of solution, system of non-homogeneous linear differential equation, general solution, particular solution, undetermined coefficients, variation of parameters.	4
5.	Definition of Laplace and inverse Laplace transform, Laplace transform of derivatives and of integrals, unit step function and Dirac delta function, translation on the s-axis, translation on the t-axis, existence and uniqueness of Laplace transform, solving ordinary differential equations using Laplace transform. Solving system of ordinary differential equations using Laplace transform.	10
6.	Series solution of ordinary differential equations: power series, power series solutions, regular points and singular points, recurrence relation, Bessel functions, eigen function solution, ortho-normal eigen functions.	4
7.	Practical engineering applications. Project	3

Ground rules:	Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are not allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessment & grading policy:	Assignments	0%		Quizzes		0%
	First Exam	20%		Projects		0%
	Midterm Exam	30%		Lab Reports		0%
	Final Exam	50%		Presentation		0%
				Total		**100%**

Last Revised:	October 2024