

MM 215E Differential Equations				DEPARTMENT of MECHANICAL ENGINEERING					
Semester	Methods of Education							Credits	
	Lecture	Recit.	Lab.	Project/Field Study	Homework	Other	Total	Credit	ECTS Credit
3	42	-	-	23	60	-	125	3	5.0
Language	English								
Compulsory / Elective	Compulsory								
Prerequisites	MAT 101								
Course Contents	First-order differential equations. Nonlinear equations reducible to linear equations. Equations of constant coefficients. System of linear equations. Linear equations with variable coefficients, and series solutions. Partial differential equations. Separation of variables. Fourier series, and integrals. Orthogonal functions. Application to boundary-initial value problems.								
Course Objectives	Learn how to use the mathematical language of nature for the understanding, modeling, and formulating of physical phenomena and engineering problems								
Learning Outcomes and Competences	Use Calculus and Differential equations for formulating mathematical models and solve problems of the real world phenomena/engineering design.								
Textbook and /or Reference	1) P.V. O’Neil, Advance Engineering Mathematics, Fifth Ed., 2003. 2) Differential Equations and Boundary-Value Problems-Computimt and Modeling. ,C.H.Edwards ,J.R.& D.E.Penney, Prentice Hall, 1966. 2) Advanced Engineering Math.,E.Kreyszig, 8th ed., John Wiley, 1999.								
Assessment Criteria						If any, mark as (x)		Percentage (%)	
	Midterm Exams					X		40	
	Quizzes					X		10	
	Homeworks					X		10	
	Projects								
	Term Paper								
	Laboratory Work								
	Other								
Final Exam					X		40		
Instructors	Assoc.Prof. Ezgi GUNAY, Assist.Prof. Cevdet AYGUN, Assist.Prof. Nureddin DINLER								
Week	Subject								
1-2	Mathematical models. Definition of linear and nonlinear differential equations. Separable equations.								
3	Solution of for various linear and nonlinear forms in y of f(x,y).								
4-5	Exact differential equations. Integrating factors. Linear first-order equation. Existence and uniqueness of solutions. Picard’s iteration.								
6-7	Second-order constant-coefficient linear differential equations. Higher-order differential equations. Characteristic equation and case of real repeated and complex roots. Euler’s formula for complex exponential function. Cauchy-Euler equation. Complex Numbers.								
8-9-10	Laplace transform method. Unit step function and their combinations for representing various piecewise discontinuous functions. Dirac delta function. First and second shifting theorems. Transformation of initial-value problems with various discontinuous loading functions. Convolution theorem. Transformation of integrals and derivatives of transforms. Unit step response and Duhamel’s principle.								
11-12-13	General souldution of a linear, variable-coefficient differential equation by power-series representation near regular and regular-singular points. Frobenious method. Legendre equation and Legendre polynomials. Solution by Frobenious method of Bessel’s equation of order zero.								
14	Systems of differential equations. Matrix eigenvalue problem. Homogeneous systems with constant coefficients. Phase plane. Critical points. Criteria for critical points. Stability. Nonhomogeneous linear systems.								