Course Title	Differential Equations				
Course Code	AMAT204				
Course Type	Required				
Level	BSc (Level 1)				
Year / Semester	2nd Year /1st Semester				
Teacher's Name	Dr. Marios Charalambides				
ECTS	5	Lectures / week	3	Laboratories/week	
Course Purpose	The purpose of the course is to introduce students with the notion of the ordinary differential equation. In our first calculus course, AMAT111, the function is given to the students and they are asked to compute the derivative. In our second calculus course, AMAT122, we have a more realistic setting where students are actually given the derivative and are asked to use integration to obtain the original function. In practice though, information about unknown functions usually comes in the form of an equation which combines the function with some of its derivatives. This equation is called a differential equation. The purpose of this course is to give a detailed view of the topic describing a number of techniques that can be used to solve the different types of differential equations.				
Learning Outcomes	• Define and explain the concept of an ordinary differential equation, employ the appropriate method to solve Separable, Linear, Homogeneous and solution by substitution, and Exact first-order differential equations. • Define the concept of second order linear ordinary differential equations, describe the general method of their solution, and calculate the general solution of second-order homogeneous differential equations with constants coefficients. • Describe the method of Reduction of Order in the solution of second order homogeneous differential equations, and employ the method to obtain the second linearly independent solution. • Describe the Methods of Undetermined Coefficients, and Variation of Parameters, use these methods to find the general solution of second-order non-homogeneous differential equations, and compare the two methods identifying their advantages and disadvantages. • Explain the concept of Power Series expansions as solutions of linear differential equations, employ the method to obtain solutions of non-homogeneous differential equations that arise in applied engineering problems, and compare the method with the methods of undetermined coefficients and variation of parameters. • Identify the importance of the method of Laplace transform in the solution of differential equations, employ the method to obtain				

	solutions of important differential equations, and compare the results with the ones given by previous methods wherever this is possible. • Define partial differential equations, and apply the method of Separation of Variables on partial differential equations to deduce a system of ordinary differential equations. • Use readily available Matlab codes to calculate solutions of differential equations that arise in Applied Engineering Problems, and compare the results with the analytic solutions obtained with the techniques learned in the course.		
Prerequisites	AMAT122	Corequisites	None
Course Content	• First Order Ordinary Differential Equations: Basic concepts and classification of differential equations. Separable, linear with integrating factor, homogeneous or solution by substitution and exact, ordinary differential equations, Applications of First-Order Differential Equations. • Second and nth-Order Ordinary Differential Equations: Linear homogeneous with constant coefficients, nth-order linear homogeneous with constant coefficients. The method of reduction of order, the method of undetermined coefficients, and the method of variation of parameters. Initial value problems and applications of second order linear ordinary differential equations. • Series of Solutions: Definition and properties, convergence, and solution of linear differential equations with constant and non-constant coefficients. • Laplace Transform: Definition and properties, partial fractions, Laplace transform and inverse Laplace transform. Solution of linear differential equations with constant coefficients. • Partial Differential Equations: Basic concepts and classification. Introduction to separation of variables. • Applied Engineering Problems using MATLAB: Calculation of solutions with readily available codes and analysis of results.		
Teaching Methodology	The course is delivered to the students by means of lectures, conducted with use of the board. The students are also engaged in the course through questions by the lecturer which are discussed in class. Several examples are solved on the white board, with the participation of students. Students are encouraged to leave their seats and solve examples on the board as well. Students are asked to work on their own during class hours on practice problems, and they are encouraged to ask questions. Many additional exercise sheets and material is available to students through the e-learning platform. Students are encouraged to attend office hours for extra help. Students are encouraged to attend the peer tutoring center for extra help.		

Bibliography	(a)Textbooks: • William E. Boyce, Richard C. DiPrima, *Elementary Differential Equations and Boundary value problems*, Wiley, 11th edition, 2017. (b) References: • B.R. Hunt, R.L.Lipsman, J.E. Osborn, J. Rosenberg, *Differential Equations with Matlab*, Wiley, 2nd edition, 2005. • C.H. Edwards, D.E. Penny, *Differential Equations, Computing and Modeling*, Prentice-Hall, 4th edition, 2007. • Kent R. Nagle, et al, *Fundamentals of Differential Equations*, 1999.
Assessment	(a) Methods: Students will be assessed with coursework that involves two in class written tests and a final exam. (b) Criteria: Assessment criteria are available in each test or in the final exam (c) Weights: Tests 40% Final Exam 60%
Language	English