

	Course name: MATH 215 Differential Equations I		Department: Mathematics				Semester																														
							3																														
	Methods of Education						Credit (ECTS)																														
Lecture	Recitation/ (Etud)	Lab	Exams	Homework	Other	Total	5																														
42	0	0	55	0	56	153																															
Language	English																																				
Compulsory/Elective	Compulsory																																				
Prerequisites	Calculus I and II																																				
Course Contents	<table border="1"> <thead> <tr> <th>Weeks</th> <th>Subjects</th> </tr> </thead> <tbody> <tr> <td>1</td> <td> Classification of the Differential Equations (DE) <ul style="list-style-type: none"> ODE (Ordinary Differential Equation) or PDE (Partial Differential Equation) linearity/nonlinearity order of a differential equation homogeneous/nonhomogeneous DE </td> </tr> <tr> <td>2</td> <td> <ul style="list-style-type: none"> Explicit and implicit solutions The difference between IVPs (Initial Value Problems) and BVPs (Boundary Value Problems) </td> </tr> <tr> <td>3</td> <td> First order ODEs <ul style="list-style-type: none"> Separable equations Exact equations </td> </tr> <tr> <td>4</td> <td> <ul style="list-style-type: none"> Integrating factors and first order linear ODEs Special transformations Bernoulli and Riccati equations </td> </tr> <tr> <td>5</td> <td> Visualizing solutions of first order ODEs using <ul style="list-style-type: none"> direction fields and integral curves </td> </tr> <tr> <td>6</td> <td> <ul style="list-style-type: none"> Higher order homogeneous/nonhomogeneous linear ODEs Linearly dependence/independence of solutions, Wronskian identity Characteristic equation and solution of homogeneous part The method of undetermined coefficients </td> </tr> <tr> <td>7</td> <td> <ul style="list-style-type: none"> The method of variation of parameters Cauchy-Euler equation </td> </tr> <tr> <td>8</td> <td>An operator method</td> </tr> <tr> <td>9</td> <td>Some applications to real world problems</td> </tr> <tr> <td>10</td> <td>Power series solutions</td> </tr> <tr> <td>11</td> <td>Power series solutions</td> </tr> <tr> <td>12</td> <td> <ul style="list-style-type: none"> Linear system of ODEs An operator method for the systems with constant coefficients </td> </tr> <tr> <td>13</td> <td>Linear algebraic methods (matrix eigenvalue method) for the homogeneous first order systems with constant coefficients</td> </tr> <tr> <td>14</td> <td>The matrix exponential method for the homogeneous first order systems with constant coefficients and a small review</td> </tr> </tbody> </table>							Weeks	Subjects	1	Classification of the Differential Equations (DE) <ul style="list-style-type: none"> ODE (Ordinary Differential Equation) or PDE (Partial Differential Equation) linearity/nonlinearity order of a differential equation homogeneous/nonhomogeneous DE 	2	<ul style="list-style-type: none"> Explicit and implicit solutions The difference between IVPs (Initial Value Problems) and BVPs (Boundary Value Problems) 	3	First order ODEs <ul style="list-style-type: none"> Separable equations Exact equations 	4	<ul style="list-style-type: none"> Integrating factors and first order linear ODEs Special transformations Bernoulli and Riccati equations 	5	Visualizing solutions of first order ODEs using <ul style="list-style-type: none"> direction fields and integral curves 	6	<ul style="list-style-type: none"> Higher order homogeneous/nonhomogeneous linear ODEs Linearly dependence/independence of solutions, Wronskian identity Characteristic equation and solution of homogeneous part The method of undetermined coefficients 	7	<ul style="list-style-type: none"> The method of variation of parameters Cauchy-Euler equation 	8	An operator method	9	Some applications to real world problems	10	Power series solutions	11	Power series solutions	12	<ul style="list-style-type: none"> Linear system of ODEs An operator method for the systems with constant coefficients 	13	Linear algebraic methods (matrix eigenvalue method) for the homogeneous first order systems with constant coefficients	14	The matrix exponential method for the homogeneous first order systems with constant coefficients and a small review
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Course Objectives	<ul style="list-style-type: none"> This course provides an introduction to the basic theoretical concepts and applications of ODEs. It aims to introduce students the real life systems modelled by means of differential equations and their appropriate solution techniques. 																																				
Learning Outcomes and Competences	By the end of this course, a student will be able to: <ol style="list-style-type: none"> identify ODEs and their qualitative properties appreciate the importance of establishing the existence and uniqueness of solutions 																																				

	<ol style="list-style-type: none"> 3. solve analytically a wide range of first order ODEs as well as Initial Value Problems (IVPs) 4. obtain approximate solution curves and direction fields using graphical techniques 5. solve analytically a wide range of higher order linear homogeneous /nonhomogeneous ODEs with constant coefficients 6. use power series to find solutions of linear ODEs 7. solve the system of linear ODEs 																																
Textbook and /or References	<ol style="list-style-type: none"> 1. Fundamentals of Differential Equations and Boundary Value Problems by Nagle, Saff and Snider, Pearson, Addison Wesley 2. Introduction to Ordinary Differential Equations by Shepley L. Ross. Fourth Edition, John Wiley and Sons 																																
Assessment Methods and Criteria	<table border="1"> <thead> <tr> <th>In-Term Studies</th> <th>Quantity</th> <th>Percentage%</th> </tr> </thead> <tbody> <tr> <td>Mid-terms</td> <td>1</td> <td>40</td> </tr> <tr> <td>Quizzes</td> <td>0</td> <td>0</td> </tr> <tr> <td>Assignments</td> <td>0</td> <td>0</td> </tr> <tr> <td>Attendance</td> <td>0</td> <td>0</td> </tr> <tr> <td>Practice</td> <td>0</td> <td>0</td> </tr> <tr> <td>Project</td> <td>0</td> <td>0</td> </tr> <tr> <td>Final Examination</td> <td>1</td> <td>60</td> </tr> <tr> <td>Total</td> <td>2</td> <td>100</td> </tr> </tbody> </table>	In-Term Studies	Quantity	Percentage%	Mid-terms	1	40	Quizzes	0	0	Assignments	0	0	Attendance	0	0	Practice	0	0	Project	0	0	Final Examination	1	60	Total	2	100					
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