MATH 202 - DIFFERENTIAL EQUATIONS (2024-2025)

Course Code	Course Name	Semester	
MATH 202	Differential Equations	Fall ☒ Spring ☐ Summer ☐	
Hours		**Credit**	**ECTS**
Theory	**Practice** / **Lab**	4	5
4	0 / 0		

Course Details	
Department	Software Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Course Objectives	The laws of nature are expressed as differential equations. The scientists and engineers must know how to model the real-world problems in terms of differential equations, and how to solve those equations and interpret the solutions. This course focuses on differential equations, solution discussions and applications in engineering majors. By the end of the course students will be able to: 1. Model a simple physical system to obtain a first order differential equation. 2. Test the solution to a differential equation (DE), looking at the graph of the solution, testing extreme cases, and checking units. 3. Find and classify the critical points of a first order equation and use them to describe the qualitative behavior and, in particular, the stability of the solutions. 4. Use known DE types to model and understand situations involving exponential growth or decay and second order physical/electrical systems such as RLC circuits. 5. Solve the main equations with various input functions including zero, constants, exponentials, sinusoids, step functions, impulses, and superpositions of these functions. 6. Solve DE's by Laplace transforms/equations. 7. Analyze fundamental Mec-EE systems using DE and Laplace

Course Content	Intro Linear Differential Equations; Method of Integrating Factors Separable Differential Equations Modeling with 1st Order Differential Equations Differences Between Linear and Nonlinear Differential Equations Exact Differential Equations and Integrating Factors Numerical Approximations: Euler's Method The Existence and Uniqueness Theorem First-Order Homogenous Difference Equations Second-Order Linear Differential Equations Homogeneous Differential Equations with Constant Coefficients Solutions of Linear Homogeneous Equations; the Wronskian Complex Roots of the Characteristic Equation Repeated Roots; Reduction of Order Nonhomogeneous Equations; Method of Undetermined Coefficients Variation of Parameters Higher Order DE Definition of the Laplace Transform (LT) & Inverse Laplace Solution of Initial Value Problems Step Functions Impulse Functions The Convolution Integral DE&LT for Engineers (SMD or RLC structures) Applications in Engineering Systems …
Course Method/ Techniques	Lecture ☒ Question & Answer ☐ Presentation ☐ Discussion ☐
Prerequisites/ Corequisites	
Work Placement(s)	

Textbook/References/Materials

- Elementary Differential Equations and Boundary Value Problems, William E. Boyce&Richard C. Diprima, Douglas B. Meade, Wiley
- Guenther R. B. And Lee J. W., Partial Differential Equations of Mathematical Physics and Integral Equations, Dover Publ. New York, 1995
- Ordinary Differential Equations for Engineers, Problems with MATLAB Solutions, Ali Ümit Keskin, Springer

Course Category				
Mathematics and Basic Sciences	☒		Education	☐
Engineering	☐		Science	☐

Engineering Design	☐		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule

No	Topics	Materials/Notes
1	Basic Concepts	Elementary Differential Equations and Boundary Value Problems-Chapter-1
2	First order variable separable and homogeneous differential equations (DE)	Elementary Differential Equations and Boundary Value Problems-Chapter-2
3	First order exact, linear and Bernoulli differential equations	Elementary Differential Equations and Boundary Value Problems-Chapter-2
4	Applications of first order differential equations	Elementary Differential Equations and Boundary Value Problems-Chapter-2
5	Second and higher order linear differential equations	Elementary Differential Equations and Boundary Value Problems-Chapter-3
6	Constant coefficient linear differential equations and Undetermined Coefficients method	Elementary Differential Equations and Boundary Value Problems-Chapter-3
7	Variations of parameters method	Elementary Differential Equations and Boundary Value Problems-Chapter-3
8	Midterm Exam	
9	Variations of parameters method	Elementary Differential Equations and Boundary Value Problems-Chapter-3
10	Higher Order DE	Elementary Differential Equations and Boundary Value Problems-Chapter-4
11	Higher Order DE	Elementary Differential Equations and Boundary Value Problems-Chapter-4
12	Laplace transform and its properties	Elementary Differential Equations and Boundary Value Problems-Chapter-6
13	Inverse Laplace transform	Elementary Differential Equations and Boundary Value Problems-Chapter-6
14	Solution of linear differential equations with constant coefficients by Laplace transform	Elementary Differential Equations and Boundary Value Problems-Chapter-6
15	Second order boundary value problems and Trigonometric Fourier series	Elementary Differential Equations and Boundary Value Problems-Chapter-10-11
16	Final Exam	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance		
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize	2	20
Homework		
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam	1	30
Final Exam	1	50
	Total	**100%**
Contribution of Midterm Studies to Success Grade		40
Contribution of End of Semester Studies to Success Grade		60
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	4	56
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	14	3	42
Quiz/Studio/Criticize	2	3	6
Homework			
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	8	8
Final Exam and Preparation for Final Exam	1	16	16
Total Workload			**128**
Total Workload / 25			**5.12**
ECTS Credit			**5.0**

Course Learning Outcomes	
No	**Outcome**
L1	Ability to propose appropriate solutions to problems in line with the inferences and learnings.
L2	Ability to make use of different problem-solving, decision-making tools and techniques.
L3	
L4	
L5	

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**P12**	**P13**	**P14**	**P15**	**Total**
L1	5	4	3													12
L2	5	4	3													12
L3																
L4																
L5																
															Total	24