

## Course Description Form

<b>1. Course Name:</b>	
Theory of Differential Equations	
<b>2. Course Code:</b>	
MS 310	
<b>3. Semester / Year:</b>	
Second Semester/2024-2023	
<b>4. Description Preparation Date:</b>	
25-3-2024	
<b>5. Available Attendance Forms:</b>	
Attendance	
<b>6. Number of Credit Hours (Total) / Number of Units (Total)</b>	
60 hours/ 4 units	
<b>7. Course administrator's name (mention all, if more than one name)</b>	
Name: Dr.Esraa Habeeb Khaleel Email: esraa.h.khaleel@tu.edu.iq	
<b>8. Course Objectives</b>	
<b>Course Objectives</b>	<ul style="list-style-type: none"> <li>• Learning about theoretical concepts of differential equations. .....</li> <li>• Studying the existence and the uniqueness theorems for solutions of differential equations.....</li> <li>• To understand the Linear independence theorems for solutions of differential equations.</li> <li>• To Learn about solving linear homogeneous differential systems using eigenvalues and eigenvectors.</li> <li>• Identify the concept of stability of solutions of differential systems and types of critical points for systems and the phase Plane and trajectory for those points</li> <li>• The ability to prove the existence and the uniqueness solutions of differential equations by applying the theorems.</li> <li>• Gaining the ability to analyze, explain and solve problems.</li> </ul>

	<ul style="list-style-type: none"> <li>• Providing the student with the skills of communication, expression and discussion to stimulate mathematical thinking, understanding and solving mathematical issues.</li> </ul>
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### 9. Teaching and Learning Strategies

<b>Strategy</b>	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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### 10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	System of Differential Equations	System of First Order Equations, Vector-Matrix Notation of Systems	Lectures	Discussion and tests
2	4	System of Differential Equations	Existence, Uniqueness, and Continuity, The Gronwall's Inequality	Lectures	Discussion and tests
3	4	Linear Systems, with an introduction to Phase Space Analysis	Existence and Uniqueness for Linear Systems, Linear Homogeneous Systems	Lectures	Discussion and tests
4	4	Linear Systems, with an introduction to Phase Space Analysis	Linear Nonhomogeneous Systems, Similarity of Matrices and Jordan Canonical Form	Lectures	Discussion and tests
5	4	Existence Theory	Existence Theory for Systems of First-Order Equations, Uniqueness of Solutions	Lectures	Discussion and tests
6	4	Existence Theory	Continuation of Solutions, Dependence on Initial Conditions and Parameters	Lectures	Discussion and tests
7	4	Stability of Linear and Almost Linear Systems	Definitions of Stability, Linear Systems, Almost Linear Systems	Lectures	Discussion and tests
8	4	Stability of Linear and Almost Linear Systems	Conditional Stability, Asymptotic Equivalence, Stability of Periodic Solutions	Lectures	Discussion and tests
9	4	Lyapunov's Second Method	Introductory Remarks, Lyapunov's Theorems	Lectures	Discussion and tests
10	4	Lyapunov's Second Method	Proofs of Lyapunov's Theorems	Lectures	Discussion and tests
11	4	Lyapunov's Second Method	Proofs of Lyapunov's Theorems	Lectures	Discussion and tests
12	4	One Dimensional Movement of a Particle	Perron's Theorem, Stability of periodic solutions and	Lectures	Discussion and tests

			other notions of stability		
13	4	One Dimensional Movement of a Particle	Classical Mechanics with One Degree on Freedom	Lectures	Discussion and tests
14	4	One Dimensional Movement of a Particle	Replicator Equation and Mathematical Biology	Lectures	Discussion and tests
15	4	One Dimensional Movement of a Particle	Replicator Equation and Mathematical Biology	Lectures	Discussion and tests

