

**Department of Science Education  
Institute of Education & Research  
University of the Punjab, Lahore  
Course Outline**



Programme	BS Science Education	Course Code	BSScEd-708	Credit Hours	04
Course Title	Mathematics A-IV [Ordinary Differential Equations]				
Course Introduction					
<p>Mathematics A-IV focuses on Ordinary Differential Equations (ODEs). In this course, students learn how to solve equations that involve derivatives of functions. Differential equations are very important in mathematics because they are used to describe real-world problems in physics, biology, engineering, economics, and many other fields. This course builds students' understanding of mathematical modeling and analytical thinking.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ol style="list-style-type: none"> <li>1. Understand the basic concepts of ordinary differential equations.</li> <li>2. Solve first-order differential equations using different methods.</li> <li>3. Solve higher-order linear differential equations.</li> <li>4. Apply differential equations to real-life problems such as growth, decay, and motion.</li> </ol>					
Course Content					
Week 1	<b>Unit -1: Introduction to Differential Equations</b>				
	1.1	Historical background and motivation			
Week 2	1.2	Basic mathematical models: Directional fields			
	1.3	Classification of differential equations			
Week 3	<b>Unit-2: Functions of Several Variables</b>				
	2.1	Separable equations			
Week 4	2.2	Modeling with first order equations			
	2.3	Differences between linear and nonlinear equations			
Week 5	2.4	Exact equations and integrating factors			
	<b>Unit-3: Second Order Differential Equations</b>				
	3.1	Homogenous equations			
Week 6	3.2	Homogenous equations with constant coefficients			
	3.3	Fundamental solutions of linear homogenous equations			
Week 7	3.4	Linear independence and the wronskian			
Week 8	3.5	Method of undetermined coefficients, Variation of parameters			
Week 9	<b>MID- TERM EXAM</b>				

<b>Week 10</b>	<b>PRESENTATIONS</b>
<b>Week 11</b>	<b>Unit-4: Higher Order Linear Equations</b>
	4.1 General theory of nth order linear equations
<b>Week 12</b>	4.2 Homogenous equations with constant coefficients
	4.3 The methods of undermined coefficients
<b>Week 13</b>	4.4 The method of variation of parameters
	<b>QUIZZ</b>
<b>Week 14</b>	<b>Unit-5: Series Solution of Second Order Linear Equations and Special Functions</b>
<b>Week 15</b>	5.1 Series solution near an ordinary point, Legendr's equation
	5.2 Regular singular points, Series solution near a regular singular point
<b>Week 16</b>	<b>FINAL- TERM EXAM</b>
<b>Textbooks and Reading Material</b>	
<ol style="list-style-type: none"> <li>1. W.E. Boyce and Diprima, Elementary Differential Equations, 8th Edition, John Wiley &amp; Sons, 2005</li> <li>2. Erwin, Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 2004</li> <li>3. Ross, S.L, Differential Equations, John Wiley &amp; Sons, 2004</li> <li>4. Dennis G.Zill &amp; Michael R. Cullen, Differential Equation With Boundary Value Problems, PWS Publihing Company, 2000</li> <li>5. Richard Bronson, Differential Equations, 2nd Edition, Schaum's Outline Series, Mc-Graw Hill Company, New York, 19</li> </ol>	
<b>Teaching Learning Strategies</b>	
<ul style="list-style-type: none"> <li>• Lecture Method</li> <li>• Collaborative Method</li> <li>• Problem-Solving Approaches</li> <li>• Demonstration Method</li> <li>• Project Method</li> <li>• Connecting mathematics to real world context</li> <li>• Discussion</li> </ul>	
<b>Assignments: Types and Number with Calendar</b>	
<ul style="list-style-type: none"> <li>• Class presentation, Quizzes.</li> <li>• 1<sup>st</sup> assignment before mid-term exam.</li> <li>• 2<sup>nd</sup> assignment after mid-term exam</li> </ul>	