

## 111學年第1學期課程綱要

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## 一、課程基本資料

開課序號	2821	課程學制	大
科目代碼	MAU0100	課程名稱	微分方程導論
英文名稱	Introduction to Differential Equations		
全/半年	半	必/選修	必修
學分數	3.0	每週授課時數	正課時數: 3 小時
開課系級	數學系 ( 學 ) 2年級		
先修課程			
課程簡介	微分方程式大多起源於物理、工程、生命科學等領域。本課程提供學生有關微分方程之基本知識，其內容主要介紹階微分方程的來源，各類解法及應用。		
	<b>課程目標</b>	<b>對應系所核心能力</b>	
	1. 熟悉微分方程的解法	學士: 1-1 熟習數學學科專業的能力 1-4 具備高等數學問題的擬題與解題能力 3-1 能以耐心、勤奮、專注以及充滿好奇心的態度尋求問題解答	
	2. 對方程之解具定量定性分析的能力	學士: 1-2 具備數學邏輯推理與歸納的能力 3-1 能以耐心、勤奮、專注以及充滿好奇心的態度尋求問題解答 3-4 具有洞察力、直覺、數學感。	
	3. 認識其他領域所推導出的方程並瞭解在數學分析的背後原始問題的意義	學士: 1-5 能以數學做為認識其他學科的工具 4-4 兼具科學與人文的世界觀，欣賞其他知識領域的價值。	

## 二、教學大綱

授課教師	陳建隆
<b>教學進度與主題</b>	
<b>課程綱要 (Course Syllabus):</b>	
<p>如果我們想將數學方法應用到物理、化學、數學生物學等交叉學科或“現實生活”問題上，首先必須用數學術語來表述問題，即必須將問題構造出一個對應的數學模型。許多這些應用問題涉及不同數量之間的關係。由於變化率在數學上由導數表示，因此數學模型通常涉及與未知函數及其一個或多個導數相關的方程式。這樣的方程式我們稱之是微分方程式。科學家和工程師必須知道如何為感興趣的問題建模，然後如何求解這些建模方程並解釋獲得的解。</p> <p>本課程研究的主要方程是驅動一階和二階線性常微分方程和<math>nxn</math>系統方程。在本課程中，我們將學習到包含以下技術來求解上述微分方程：特徵方程、指數響應公式、拉普拉斯變換、卷積積分、傅里葉級數、複數運算、參數變化、消元與反消元、矩陣特徵值法等。</p> <p>本課程預計的教學進度如下。</p> <p>Weeks 1-4 :</p> <p>1 Introduction</p> <p>2 First-Order Differential Equations</p> <p>Weeks 5-10 :</p> <p>3 Second-Order Linear Differential Equations</p> <p>4 Higher-Order Linear Differential Equations</p>	

Weeks 11-16:

5 Series Solutions of Second-Order Linear Equations

6 The Laplace Transform

第 17-18 週：學生學習在線材料並討論。

**Reference Book:**

Boyce's Elementary Differential Equations and Boundary Value Problems, 11th Edition, Global Edition, [William E. Boyce](#), [Richard C. DiPrima](#), [Douglas B. Meade](#).

Course Syllabu :

If we want to apply mathematical methods to interdisciplinary or "real life" problems such as physics, chemistry, and mathematical biology, we must first express the problem in mathematical terms, that is, we must construct a corresponding mathematical model for the problem. Many of these application problems involve relationships between different quantities. Since the rate of change is mathematically represented by derivatives, mathematical models usually involve equations related to an unknown function and one or more of its derivatives. Such equations are called differential equations.

Scientists and engineers must know how to model the problem of interest, and then how to solve these modeling equations and interpret the obtained solutions. This course focuses on linear differential equations and their applications in science and engineering. In this course, we will learn to solve the above differential equations including the following techniques: characteristic equation, exponential response formula, Laplace transform, convolution integration, Fourier series, complex number operations, parameter variation, elimination and Inverse elimination, matrix eigenvalue method.

**The plan of teaching schedule and topics of this course are as follows.**

Weeks 1-4 :

1 Introduction

2 First-Order Differential Equations

Weeks 5-10 :

3 Second-Order Linear Differential Equations

4 Higher-Order Linear Differential Equations

Weeks 11-16:

5 Series Solutions of Second-Order Linear Equations

6 The Laplace Transform

**Weeks 17-18: Students study online material and discuss.**

**Reference Book:**

Boyce's Elementary Differential Equations and Boundary Value Problems, 11th Edition, Global Edition, [William E. Boyce](#), [Richard C. DiPrima](#), [Douglas B. Meade](#).

**教學方法**

方式	說明
講述法	In this course, we will study the basic principles and knowledges of elementary differential equations and some related models of application sciences.
討論法	The key points of the related studying topics are discussed in groups by students.
問題解決教學	For each group students will read and give a report of selected exercises and related topics.

**評量方法**

方式	百分比	說明
作業	10 %	每章節學後練習作業與Home Works · 成績佔學期成績10%。
期中考	30 %	一次期中考試。成績佔學期成績 30%。 We will give an mid-exam. to test the students for the study of basic related mathematical models and knowledges (30%).

期末考	40 %	一次期末考試。成績佔學期成績 40%。 We will give an final exam. to test the students for the study of basic related mathematical models and knowledges.(40-%)..
其他	20 %	兩次小考，成績各佔學期成績10%。
參考書目	<b>Reference Book:</b> Boyce's Elementary Differential Equations and Boundary Value Problems, 11th Edition, Global Edition, <a href="#">William E. Boyce</a> , <a href="#">Richard C. DiPrima</a> , <a href="#">Douglas B. Meade</a> .	