

一、課程說明(Course Description)

本課程旨在訓練工程專業的大學部二年級學生建立如下的能力：

一、從工程現象中建立數學模型

二、以如下的數學方法解決上述的方程式

(a)線性常微分方程，級數解微分方程, Laplace transform

(b)線性代數方程式系統、向量空間、矩陣及線性方程式，  
Eigenvalue problem

二、指定用書(Text Books)

"Advanced Engineering Mathematics", by M.D. Greenberg

三、參考書籍(References)

"Advanced Engineering Mathematics", by Zill and Wright

四、教學方式(Teaching Method)

課堂教學

五、教學進度(Syllabus)

**Part I Ordinary Differential Equations**

Chapters 1 Introduction to Differential

1.1 Introduction

1.2 Definitions

1.3 Introduction to modeling

Chapter 2 Introduction to differential equation and Equation of first order

2.1 Introduction

2.2 The linear equation

2.3 Applications of the linear equation

2.4 Separable equations

2.5 Exact equations and integrating factors

Chapters 3 Linear differential equation of second order and higher

3.1 Introduction

3.2 Linear dependence and linear independence

3.3 Homogeneous equation: General solution

- 3.4 Solution of homogeneous equation: Constant coefficient
- 3.5 Application to harmonic oscillator: Free Oscillation
- 3.6 Solution of homogeneous Equation: Nonconstant Coefficients
- 3.7 Solution of nonhomogeneous Equation
- 3.8 Application to harmonic oscillator: Forced Oscillation

#### Chapters 4 Power series solutions

- 4.1 Introduction
- 4.2 Power series solutions
- 4.3 The Method of Frobenius
- 4.4 Legendre Functions
- 4.5 Singular Integrals; Gamma Function
- 4.6 Bessel Functions

#### Chapters 5 Laplace transform

- 5.1 Introduction
- 5.1 Calculus of the transform
- 5.3 Properties of the transform
- 5.4 Application to solution of differential equations
- 5.5 Discontinuous forcing functions: Heaviside step function
- 5.6 Impulsive forcing functions; Dirac Impulse Function
- 5.7 Additional properties

### **Part II: Linear Algebra**

#### Chapter 8 Systems of Linear Algebraic Equations; Gauss Elimination

- 8.1 Introduction
- 8.2 Preliminary ideas and geometrical approach
- 8.3 Solution by Gauss elimination

#### Chapter 9 Vector Space

- 9.1 Introduction
- 9.2 Vectors; geometrical representation
- 9.3 Introduction of angle and dot product
- 9.4  $n$ -Space
- 9.5 Dot product, norm, and angle for  $n$ -space
- 9.6 Generalized vector space
- 9.7 Span and subspace
- 9.8 Linear dependence
- 9.9 Bases, Expansions, Dimension

## 9.10 Best approximation

### Chapters 10 Matrices and Linear Equation

10.1 Introduction

10.2 Matrices and matrix algebra

10.3 The transpose matrix

10.4 Determinants

10.5 Rank; application to linear dependence and to existence and Uniqueness for  $Ax = c$

10.6 Inverse matrix, Cramer's rule, factorization

10.7 Change of basis

### Chapters 11 The Eigenvalue Problem

11.1 Introduction

11.2 Solution procedure and applications

11.3 Symmetric matrices

11.4 Diagonalization

### 六、成績考核(Evaluation)

期中考一(25%)、期中考二(25%)、期中考二(25%)、期末考(250%)、小考及出席(加分參考)