09910MS 201101 工程數學一(Engineering Mathematics I)

09910MS 201102 工程數學一(Engineering Mathematics I)

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，Eignvalue problem

二、指定用書(Text Books)

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

三、參考書籍(References)

"Advanced Engineering Mathmatics", 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

Chapter 6 Quantitative Methods: Numerical Solution of Differential Equations
6.1 Introduction
6.2 Euler's method
6.3 Improvements: Midpoint rule and Runge-Kutta

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%)、期末考(30%)、小考及出席(20%)