Content

Finite Element Method

Credits: 3 Hours: 3
Semester: Spring 2023
Program: Mechanical Engineering
Level: Graduate

Course Description and Objectives

This course introduces the fundamentals of the finite element method (FEM) and its application to the engineering problems. The relevant software packages will also be included. The basic concepts, models, analyses and relevant software packages of the finite element method are presented so that the students may have a basic knowledge of the theory and applications of the FEM.

Course Outlines

The course will cover the following important topics:

1. Introduction to the Finite Element Method
2. Discretization of the Domain
3. Interpolation Models, Higher Order and Parametric Elements
4. Derivations of Element Matrices and Vectors
5. Assembly of Element Matrices and Vectors and Derivations of System Equations
6. Numerical Solution of Finite Element Equations
7. Solid Mechanics Problems – Basic Equations and Solution Procedure
8. Analysis of Trusses, Beams, Frames and Plates (with practice)
9. Analysis of Three-Dimensional Problems (with practice)
10. Introduction to FEM software packages (with practice)

Mechatronics

Credits: 3 Hours: 3
Semester: Fall
Program: Mechanical Engineering
Level: Graduate

Course Description and Objectives

This course provides students with the basic training in mechatronics skills. Students taking this course will learn the functions of some frequently used mechatronics components and their applications. This course trains students the basic function of Mechatronics components and their applications. Starting from how to build a simple On-Off control logic circuit to the programming of PLC, several practical Mechatronics skills will be presented in this course. Students need to practice these skills in class to be familiar with the skills. Couple exams will be given to let students to demonstrate their capability of using such skills.

Course Outlines

The course will cover the following important topics:

1. Introduction of Mechatronics
2. Some basic Mechatronics components
3. The circuits formed by Mechatronics components
4. Practices
   practice 1: simple serial and parallel circuits.
   practice 2: building a simple on-off control circuit
   practice 3: building a simple on-off control circuit for Motor
   practice 4: building a simple on-off control circuit for Motor with timers
   practice 5: building a simple blinking control circuit with timers
5. Sensors and their applications (with practice)
6. PLC and ladder diagram (with practice)
7. Practices on PLC applications

Modern Control Theory

Credits: 3 Hours: 3

Semester: Fall 2021

Program: Mechanical Engineering

Level: Graduate

Course Description and Objectives

This course introduces the fundamental properties and design methods of linear control systems.

Course Outlines

1.Mathematical Descriptions of Systems

2.Linear Algebra

3.State-Space Solutions and Realizations

4.Stability

5.Controllability and Observability

6.Minimum Realization

7.State Feedback and State Estimators

8.Pole Placement and Model Matching

Vibration Analysis of Precision Machinery

Credits: 3 Hours: 3
Semester: Fall 2022
Program: Mechanical Engineering
Level: Graduate

Course Description and Objectives

This course covers theoretical part and experimental part of the modal analysis. Several lab works and a final project will be assigned in this course for practice. In this course, students will obtain the techniques of vibration measurement and analysis.

Course Outlines

1. Modal Theory - Single Degree of Freedom System
2. Modal Theory - Multiple Degree of Freedom System
3. Vibration Measurement Techniques
4. Response Function Measurement Techniques
5. Modal Parameter Extraction Methods
6. Modal Modifications

Principles of Fuel cells

Credits: 3 Hours: 3
Semester: Fall 2022
Program: Mechanical Engineering
Level: Graduate

Course Description and Objectives

Fuel cells, thought to be the future power source, have been developed for more than 1.5 centuries. This course will introduce this technology from the fundamental principles to the practical applications.

Course Outlines

1.Introduction
2.Electrochemical principles of Fuel Cells
3.Types of fuel cell
4.Fueling fuel cells
5.Possible Applications
6.Practical operation

Finite Element Methods

Credits: 3 Hours: 3
Semester: Spring
Program: Mechanical Engineering
Level: Graduate

Course Description and Objectives

This course introduces the fundamentals of the finite element method (FEM) and its application to the engineering problems. The relevant software packages will also be included.

Course Outlines

1. Introduction to the Finite Element Method
2. Discretization of the Domain
3. Interpolation Models, Higher Order and Parametric Elements
4. Derivations of Element Matrices and Vectors
5. Assembly of Element Matrices and Vectors and Derivations of System Equations
6. Numerical Solution of Finite Element Equations
7. Solid Mechanics Problems – Basic Equations and Solution Procedure
8. Analysis of Trusses, Beams, Frames and Plates
9. Analysis of Three-Dimensional Problems
10. Introduction to FEM software packages

TRIZ Applications

Credits: 3 Hours: 3
Semester: Spring
Program: Mechanical Engineering
Level: Graduate

Course Description and Objectives

This course will introduce The Theory of Inventive Problem Solving: TRIZ. Including the historic background of TRIZ, the 40 inventive principles, and the separation principles will be presented in this course. This course guides students to become inventive by following the basic principles given by TRIZ.

Course Outlines

The course will cover the following important topics:

1. How to be Creative;
2. Theory of Inventive Problem Solving: TRIZ;
3. Historic Background of TRIZ;
4. The Content of TRIZ;
5. Ideal Final Results;
6. Level of Creativity;
7. Physical Contradiction;
8. Principles of Separation
9. Technical Contradiction;
10. 40 Inventive Principles; (with practice)

Advanced Practical Precision Control Systems

Credits: 3 Hours: 3

Semester: Spring 2022

Program: Mechanical Engineering

Level: Graduate

Course Description and Objectives

To provide students with knowledge of practical precision control systems.

Course Outlines

1. Introduction
2. Positioning Systems
3. Metrology
4. DSP
5. Practical Control Methodology and Related Issues
6. Applications

Optimal Control

Credits: 3 Hours: 3
Semester: Spring 2023
Program: Mechanical Engineering
Level: Graduate

Course Description and Objectives

It offers as self-contained a presentation as possible and, for reference sake, includes many background results on linear systems, the theory and application of Riccati equations and model reduction.

Course Outlines

1. Linear algebra
2. Linear dynamical systems
3. Algebraic Riccati equations
4. Performance specifications
5. H2 Optimal control
6. Linear quadratic optimization

Digital Image Processing and Application

Credits: 3 Hours: 3
Semester: fall
Program: Electrical Engineering
Level: Graduate

Course Description and Objectives

All key concepts of Digital Signal Processing （DSP）are covered in the course. Practical problems will be presented and solved. Advanced applications of DSP for sound and images are also investigated.

Course Outline

1. Crash Course in Digital Signal Processing
2. Analog-to-Digital and Digital-to-Analog Conversion
3. Digital Signals
4. Difference Equations and Filtering
5. Convolution and Filtering
6. Z Transforms
7. Fourier Transforms and Filter Shape
8. Digital Signal Spectra
9. Finite Impulse Response Filters
10. Infinite Impulse Response Filters
11. DFT and FFT Processing
12. Introduction to Audio Signal Processing
13. Introduction to Image Processing

Electric Power Quality

Credits: 3 Hours: 3
Semester: Fall
Program: Electrical Engineering
Level: Graduate

Course Description and Objectives

This course includes the following topics: (1) power quality definition (2) power harmonic (3) voltage flicker (4) three-phase unbalance (5) frequency variation and (6) voltage sag etc.
The purpose of this course is to teach students the fundamental concepts of this subject and to equip them to recognize and solve power quality problems.

Course Outline

1. Power Quality Definition
2. Power System Harmonic
3. Voltage Flicker
4. Three-phases Unbalance
5. Frequency Variation
6. Voltage Sags

Power System Operation and Control

Credits: 3 Hours: 3

Semester: Fall

Program: Electrical Engineering

Level: Graduate

Course Description and Objectives

Power Generation Operation and Control

Course Outline

1.Practice of TPC operation and dispatch

2.Deregulation and IPP

3.Dispersed/Renewable generation

4.Characteristics of Power Generation Units

5.Economic Dispatch of Thermal Units and Method of Solution

6.Transmission System Effect

7.Unit Commitment

8.Hydrothermal Coordination

9.Control of Generation

10.Optimal Power Flow

Biomedical Signal Processing and Analysis

Credits: 3 Hours: 3

Semester: Fall

Program: Electrical Engineering

Level: Graduate

Course Description and Objectives

Fundamental of digital signal processing

Course Outline

1. Introduction
2. Fourier analysis
3. Filtering for removal of artifacts
4. Classical methods of power spectral estimation: nonparametric methods
5. Modern methods of power spectral estimation: parametric model-based methods
6. The application

Biostatistics

Credits: 3 Hours: 3

Semester: Spring

Program: Electrical Engineering

Level: Graduate

Course Description and Objectives

1. Descriptive statistics
2. Probability and probability distributions
3. Sampling Distribution of the mean
4. Confodence intervals and hypothesis testing
5. Comparison of two mean
6. Analysis of variance
7. Contingency tables
8. Correlation
9. Sample linear regression
10. Nonparametric methods

Course Outline

1. Descriptive statistics
2. Probability and probability distributions
3. Sampling Distribution of the mean
4. Confodence intervals and hypothesis testing
5. Comparison of two mean
6. Analysis of variance
7. Contingency tables
8. Correlation
9. Sample linear regression
10. Nonparametric methods

Advanced Robotics

Credits: 3 Hours: 3
Semester: Spring
Program: Electrical Engineering
Level: Graduate

Course Description and Objectives

Course Outline

1. Introduction to autonomous mobile robots
2. Locomotion
3. Mobile Robot Kinematics
4. Perception
5. Mobile Robot Localization
6. Planning and Navigation
7. Behavior-based control system
8. Robotic Intelligence
9. Other Aspects of Autonomous Mobile Systems
10. Applications on Robotics – for Example by Industrial Robots

Advanced Applications of Microcontrollers

Credits: 3 Hours: 3

Semester: Spring

Program: Electrical Engineering

Level: Graduate

Course Description and Objectives

Course Outline

1. Basic concept
2. Memory structure
3. Instruction set
4. Input/Output
5. Interrupt structure
6. Timer
7. A/D converter & D/A converter
8. Application technique.
9. Application experiment
10. Advanced application experiment.

Design Concepts of Assistive Technology Devices

Credits: 3 Hours: 3

Semester: Spring

Program: Electrical Engineering

Level: Graduate

Course Description and Objectives

Course Outline

1.Technologies for personal mobility

2.Augmentative and alternative communication system

3.Technologies that aid manipulation and control of the environment

4.Sensory aids for persons with visual, auditory, or tactile impairments

Renewable energy system design

Credits: 3 Hours: 3
Semester: Spring
Program: Electrical Engineering
Level: Graduate

Course Description and Objectives

Course Outline
1. Energy and Electricity
2. Features of Conventional and Renewable Generation
3. Power Balance / Frequency Control
4. Electrical Power Generation and Conditioning
5. Power System Analysis
6. Renewable Energy Generation in Power Systems
7. Power System Economics and the Electricity Market
8. The Future – Towards a Sustainable Electricity Supply System