平成２４年度秋学期

Fall Semester, 2012

電気通信大学・短期留学プログラム

UEC Exchange Program

Japanese University Studies
in Science and Technology
(JUSST)

Center for International Programs and Exchange (CIPE)

The University of Electro-Communications (UEC), Japan

INDEX

１. Communication Systems ・・・・・・・・・・・・・・・・・・・・・・・・ 2

２. Computational Complexity・・・・・・・・・・・・・・・・・・・・・ 3

３. Quality and Reliability Engineering; The Japanese Way・・4

４. Thermal Engineering and Biomedical Engineering・・・・・ 5

５. GO -- Playing and Computing・・・・・・・・・・・・・・・・・・・6

６. Terrestrial Electromagnetic Environment・・・・・・・・・・7

７. Fundamental Concepts of Discrete-time Signal Processing・8

８. Interactive Computer Graphics・・・・・・・・・・・・・・・・・9

９. Video and Image Technologies・・・・・・・・・・・・・・・・・10

10. Experimental Electronics Laboratory・・・・・・・・・・・・・11

11. VLSI Devices and Technology・・・・・・・・・・・・・・・・・・・12

12. Radio Wave Engineering ・・・・・・・・・・・・・・・・・・・・・・13

13. Computer Algorithms・・・・・・・・・・・・・・・・・・・・・・・・・14

14. Communication Systems Laboratory ・・・・・・・・・・・・・・・16

1．Communication Systems

Lecturer

Professor Noboru TOYAMA

Course Description

This course must be taken concurrently with the course ″Communication Systems Laboratory.″ First two classes will be review sessions that concentrate efforts on familiarizing students with the basic mathematical knowledge including the subjects listed in the prerequisites. Students who do not have confidence in those items are requested to make extra efforts to catch up with other students during the first two classes. This course together with "Communication System Laboratory" discusses in depth how digital and analog communication systems work. The basic tools used here are waveform analyses. Topics covered in this course are, signal analysis, the Fourier spectrum, the autocorrelation function, power spectrum, line coding, inter-symbol interference, roll-off filters, the discrete Fourier transform, the Hilbert transform, and various types of modulation. Some experiments in threshold effects in the presence of noise are included. From the first chapter up to chapter 7 of the textbook will be covered during the course hours. The remaining chapters will be covered in the course given in the spring semester.

Textbook

Modern Digital and Analog Communication Systems, Third Edition, by B.P. Lathi (Oxford University Press, 1998)

Pre-requirement

Trigonometric identities, Integrals, Fourier series, and some other basic knowledge of mathematics, and LCR circuits.

2．Computational Complexity

Lecturer

Dr. Jun TARUI

Textbook

No required textbook

Pre-requirement

Students taking this course should have taken an introductory course on algorithms.

Course Description

Objectives

Computational Complexity studies questions such as "Which computational problems have efficient algorithms?" and "Do quantum computers have more computational power than classical computers?"

This course aims to give students an introduction to Computational Complexity.

Outline of Class and Contents

The first half of the course will be about the following variety of algorithmic paradigms:

1) randomized algorithms,

2) learning algorithms,

3) on-line algorithms,

4) approximation algorithms.

The second half will be about:

1) complexity classes including the important classes P and NP

2) theory of NP-completeness

3) Theoretical cryptography.

３． Quality and Reliability Engineering; The Japanese Way

Lecturer Course Description

Day of Class	Monday #4 (W5-209)
Credit	2
Lecturer	Professor Kazuyuki SUZUKI and Dr. Lu JIN
E-mail	suzuki@se.uec.ac.jp, jin.lu@uec.ac.jp
Textbook	nothing (handout prints)
Prerequisites	Calculus

Course Description

Lot of Japanese products have been spreading out all over the world. One of these reasons is high quality and reliability of Japanese products. Quality control (QC) in Japan has developed after World War 2, and now the Japanese way of QC is adopted in USA, Europe and Asia. In USA, reliability and quality are categorized in different fields but in Japan they are considered to be closely related each other. This lecture course focuses on the philosophy, ideas and scientific method used to build quality and reliability into products and systems. Also, recent development of information technology has been changing the way of QC and Reliability Engineering. This new aspects is also dealt with.

1. World Wide Quality Revolution
   History of Quality and Quality Control, Origin of "Made in Germany", Japanese TQC and its Spread to the World, Rally of USA.
2. Quality Assurance (QA) and Total Quality Management
   Meaning of Quality, What is QA? New Product Development and QA, Quality Functional Development, Four leading principles of Japanese TQC.
3. Statistical Quality Control
   QC seven tools, Statistical Process Control, Design of Experiments

4. Thermal Engineering and Biomedical Engineering

Day of Class: Monday #4
Credit: 2
Lecturer: *Professor Yukio Yamada*
E-mail: yamada@mce.uec.ac.jp
Textbook: Handouts will be prepared in the classes

References:

Yunus A. Çengel, "Introduction to Thermodynamics and Heat Transfer," McGraw-Hill, 1997

Yunus A. Çengel and Michael A. Boles, "Thermodynamics, An Engineering Approach," 2nd Ed., McGraw-Hill, 1994

Frank P. Incropera and David P. DeWitt, "Introduction to Heat Transfer," 3th Ed., John Wiley & Sons, 1996

Robert Splinter, Ed., "Handbook of Physics in Medicine and Biology," CRC Press, 2010

Prerequisites: Introductory Calculus and Physics
Course Description
Objectives:

Heat is one of the energy sources which generate effective works for human activities. Fundamental physics of heat as an energy source are described by thermodynamics and heat transfer which are two closely related basis sciences. This course is to learn the basic principles of thermodynamics and heat transfer for engineering applications which include the thermal engines, power plants, air conditioners, etc., and aims to obtain skills for application through practices. Another theme of this course is biomedical engineering which covers a broad range of scientific and engineering disciplines applied to biology and medicine. Less systematic explanations will be provided for selected topics in this field, such as x-ray computed tomography, magnetic resonance imaging, optical diagnosis, etc.

Outline of Class and Contents:

1. Thermal Engineering
   - 1-1. Basic concepts of thermodynamics
   - 1-2. The first law of thermodynamics
   - 1-3. The second law of thermodynamics
   - 1-4. Entropy
   - 1-5. Power and refrigeration cycles
   - 1-6. Heat conduction
   - 1-7. Heat convection
   - 1-8. Radiation heat transfer
   - 1-9. Heat exchangers
2. Biomedical Engineering

   Selected topics such as x-ray CT, MRI, optical diagnostics, etc.

Assessment policy:

Assessment will be based on the level of understanding being judged from reports and discussions.

5. GO -- Playing and Computing

Lecturer　Masakazu MURAMATSU

Pre-requirement

Basic Skill in Programming and Data structure

Course Description

Objectives

GO is a board game played by putting black and white stones alternately. Although the rule is simple, you must learn many tactics to play GO. Strategy is also important, and even more difficult to master. Japan, China, and Korea have professional GO players organization. While computers can easily beat the best human player in Chess, it is only these three years that computers can play GO as well as average amateur players. In this sense, GO is by far deep and difficult.

In the first part of the course, you will learn how to play the game of GO.
The first goal of this course is to acquire a skill to play GO on a small board by yourself.
Then, the course is focused on developing programs to play GO.
Various techniques and algorithms needed in writing such programs will be shown.
The second and the last goal of this course is to understand the framework of Game Tree Search and Monte-Carlo Tree Search.
We encourage to visit and observe the sixth UEC Cup computer GO competition held at UEC on March.

Outline of Class and Contents　-- Part I : Playing --

1 Introduction
2 The Rule and Basic Tactics
3 Techniques to capture Stones
4 Dead or Alive
5 Playing GO through the Internet
6 Ko
7 Solving Local Problems
8 Playing Altogether

-- Part II --

9 Game Tree
10 Min-max Search and alpha-beta Search
11 Monte-Carlo Approach
12 Upper Confidence Bound
13 Monte-Calro Tree Search
14 Test
15 Solution

6．Terrestrial Electromagnetic Environment

Lecturer

Yasuhide HOUBARA

Course description

This international course introduces students to the exciting field of electromagnetic phenomena in the vicinity of the Earth in the view point of LAIM (Lithosphere- Atmosphere- Ionosphere- Magnetosphere) coupling. Wide in its scope, particular emphasis is placed on the electromagnetic waves such as the waves in the space environment, waves from thunderstorm and from seismic activity. You will gain greater experience of related research work on above-mentioned topics and have an opportunity to know how the electromagnetic waves contribute to our society monitoring the earth environment.

Course Content

This is a list of typical topics to be offered for the course.

- Electromagnetic waves (basics)
- Space environment
- Ionosphere and magnetosphere
- Space weather
- Electromagnetic waves in terrestrial atmosphere
- Electromagnetic phenomena associated with seismic activity

Requirements

Electromagnetics I and II

Textbook

Umran S. Inan, Aziz Inan: Electromagnetic Waves, Prentice Hall 1999

7．Fundamental Concepts of Discrete-time Signal Processing

Lecturer

Nobuo HAMANO

Course Description

An increasing number of electronic systems today, to name a few:

Television; audio; wireless communication systems; and medical instrumentation rely heavily on digital signal processing technologies for achieving their superb performance and sophisticated functionalities. Also it should be noted that besides discrete-time signals obtained by sampling original continuous-time signals, there exist many kinds of data or signals that are inherently observable only in discrete-time intervals such as data on economic activities, and spatial distribution of climate data. Now software tools for digital signal processing are widely and readily available for use in a wide variety of science and technology fields as well as economics and social sciences. It is quite important, however, for people using these tools to have a certain level of comprehension on the underlying concepts of digital signal processing technologies so that they can utilize them correctly and interpret their results properly. Considering these backgrounds, the aim of this course is to introduce the basic concepts and techniques underlying the digital signal processing.

Through this course students are expected to understand mathematical process of deriving these concepts as well as their significance.

Outline of Class and Contents

The course will focus on fundamental concepts of discrete-time signals and systems. Along with lectures in the class, reading assignments and homework problems serve as an integral part of the course.

Topics covered in the course are as follows,

1. Discrete-time signals and systems – Introduction, discrete-time signals: sequences

2. Discrete-time signals and systems –Discrete-time systems, linear invariant systems

3. Discrete-time signals and systems–Frequency-domain representation of discrete-time signals and systems

4. Discrete-time signals and systems –Fourier Transform theorems

5. The Z-Transform – Z-transform, properties of the region of convergence

6. The Z-Transform – The inverse Z-Transform, Z-Transform properties

7. Midterm examination

8. Sampling of continuous-time signals – Introduction, periodic sampling, frequency domain representation of sampling

9. Sampling of continuous-time signals – Reconstruction of a band-limited signal from its samples

8．Interactive Computer Graphics

Lecture Note

10/11 Introduction of this lecture, and History of Computer Graphics

10/18 Computer Graphics

10/25 Virtual Reality

11/ 1 Immersive Projection Technology

11/ 8 Projector and Motion Capture

11/15 Cancelled (Chofu Festival)

11/22 3D Computer Graphics

12/29 GPU Technology

12/ 6 Stereoscopic Image Technology

12/13 CG Animation

12/20 Latest Interface Technology

1/10 TBD

1/17 TBD

1/24 TBD

1/31 Student Presentation

Tasks ■ now printing...

Contacts

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9. Video and Image Technologies

Lecturer

Prof.Akihiro HORI

Course Description

Video technology is very important for human interface especially in the digital era. In this lecture, we will learn fundamentals for video and image technology from video cameras to displays, how it works.

The goal of this lecture

1) Understanding the fundamentals of the video and image technology.

2) Understanding the latest technology for the video and image technology.

The resume of the lecture

1. Video Camera/Image Capture Device
2. Display Device
3. Image Resolution
4. Video Format
5. Digital Cinema
5. Analog TV
6. Digital Video Compression
7. 3D Video
8. Video Effect
9. Subjective Assessment
10. Digital WaterMark

How to proceed the lecture

This lecture is interactive. Let’s study together. The speed of the innovation is so fast in digital technology, video is no exception. We will study the latest video technology from video camera to display including 3D.

Pre-requirement

It is required for the students who take this lecture to have some basic knowledge about semiconductor, digital filter and sampling theory.

10. Experimental Electronics Laboratory

Lecturer

Prof. Shigeo HAYASHI

Course Description

Objectives

This course aims for providing the students, who may have no practical knowledge of electrical circuits, with the basics of electronics.

Outline of Class and Contents

The student builds following seven electrical circuits on the solderless breadboard and measure and analyze various properties. The experiments are carried out every other week, and classroom discussion is held in between.

1) Measurement of the complex impedance for R using an oscilloscope.

2) Measurement of the complex impedance of for L and C.

3) Resonant behavior of composite LC circuits.

4) Transient response of composite LC circuits.

5) DC and AC characteristics of a bipolar junction transistor.

6) Basic properties and an application of an operational amplifiers.

7) TTL logic gates.

Classroom session is devoted to the discussion of the experimental results obtained in the preceding week, followed by a prelaboratory lecture for the next week.

11. VLSI Devices and Technology

Lecturer

Prof. Shinji NOZAKI

Course Description

This course consists of series of lectures and labs covering device physics of silicon bipolar transistors and MOSFET's and VLSI process technology and exposes you to state-of-the-art semiconductor process equipment in the clean room.

This will include the following topics:

1. Bipolar transistors
2. MOS capacitors
3. MOSFET's
4. CCD's, MOS memories (DRAM, SRAM, EPROM, Flash)
5. VLSI process technology

Prerequisites

Semiconductor physics or equivalent courses

12. Radio Wave Engineering

Lecturer

Professor Noboru TOYAMA

Course Description

This course will cover the basic ideas of radio waves, radio propagation and antennas. The subject will include the following:

1) Fundamentals of Electromagnetic Theory

2) Characteristics of Electromagnetic Waves

3) Wave Propagation

4) Antennas

5) Recent Topics of Radio Waves and Antennas

6) Some

Experiments on the selected items from the above will also be given

13. Computer Algorithms

Lecturer

Satoshi KOBAYASHI

Course Description

With rapid progress of the computer and information technologies, the theory of computer algorithms is regarded as one of the most important theories in order to use computers effectively and smartly. In this lecture, we will learn some methods to analyze and design efficient computer algorithms for several fundamental computing problems. The following is the goal of this lecture:

1) Understand the behavior, correctness, and the time and space complexity analysis of the algorithms presented at the lecture.

2) Understand principles of basic design methods of computer algorithms, including, greedy method, dynamic programming method, etc.

Contents of the lecture

1) Introduction

2) Data Structures

3) Minimum Spanning Tree

4) Kruskal's Algorithm

5) Prim's Algorithm

6) Shortest Path Problem

7) Floyd Warshall's Algorithm

8) Dijkstra's Algorithm

9) Greedy Method and Dynamic Programming Method

10) Example Applications of Greedy Method]

11) Example Applications of Dynamic Programming Method(1)

12) Example Applications of Dynamic Programming Method(2)

13) String Maching Algorithm(1)

14) String Maching Algorithm(2)

15) Summary

How to precede the lecture

We emphasize and focus on the proof and time complexity analysis of the algorithms, since theoretical understanding of algorithms is very important when you apply the design methods to new encountered problems.

Textbook 11

Some handouts will be provided.

Pre-requirement

Introduction to theory of computation, if possible.

14. Communication Systems Laboratory

Lecturer

Professor Noboru TOYAMA

Textbook

"Modern Digital and Analog Communication Systems" Third Edition, by B.P.Lathi (Oxford University Press, 1998)

Prerequisites

Trigonometric identities, Integrals, Fourier series, some basic knowledge of probabilities and LCR circuits. Students are encouraged to take "Communication Systems" open at the fall semester.

Course Description

This course is an exercise session for the course "Communications Theory. "This course must be taken concurrently with the course "Communications Theory." Students will be given problems directly related to the lecture given in "Communications Theory." By solving the problems students can understand the real aspects of the theory given in the lecture. Some experiments related to the lectures will also be given.

Assessment policy

The same scores will be given in the course "Communications Theory."