جامعة الموصل

كلية الهندسة

قسم الهندسة الكهربائية

مناهج الدراسات العليا

الماجستير - الفصل الأول

2024-2023

قسم الهندسة الكهربائية

University of Mosul

College of Engineering

Department: Electrical

Instructor: Dr Yasir & Dr. M. Natiq

Course Title: Power Electronics

Course Code: EEP 667

Hours/ Units: 2

Level/Term: MSc./1

Course Description:

This course reviews the modern concepts of power conversion and presents the contemporary concepts and techniques for power converter designs analysis and control. Principles of converter circuit analysis are introduced, and are developed for finding the steady state voltages, current, and efficiency of power converters. Some design aspects have been covered such as selection of elements. Assignments focus on self-study and writing reports considering new converter circuits or methods.

By the end of the course, student should be able to:

1. Identify the contemporary power switching devices, features, characteristics and losses.
2. Identify the 1- phase and 3-phase SCR Converter circuits.
3. Carry out detailed analysis of the phase controlled converters.
4. Identify isolated and non-isolated DC/DC converter circuits.
5. Analyze and design non-isolated DC power supply circuits.
6. Describe, analyze and compare various PWM techniques applied for DC/AC converters.
7. Describe and evaluate the current source inverters.
8. Define the basic topologies and control techniques of multilevel inverters.

References:

1. Introduction to Modern Power Electronics by Andrzej M. Trzynadlowski 3rd edition ISBN: 978-1-119-00321-2, Wiley (2015)
2. Power electronics by N. Mohan, T. Undeland, and W. Robbins
3. Power Electronics Circuit Analysis and Design by Issa Batarseh and Ahmad Harb; Springer International Publishing AG (2018).
4. C. W. Lander, “Power Electronics”

Course Details:

Subject	Week
Introduction to power conversion basics and overview of power semiconductor devices characteristics.	1
Phase- controlled and uncontrolled SCR Converters (part I: 1φ and 3φ circuits and waveforms)	2
Phase-Controlled SCR Converter (part II: Analysis of 1φ circuits).	3
DC-DC isolated and non-isolated converters (part II: circuits and waveforms).	4
DC-DC non-isolated converters (Design and averaging state -space model analysis)	5
Resonant converters (part I: Introduction)	6
Resonant converters (part I: Analysis and design)	7
DC/AC PWM techniques (part I: carrier comparison)	8
DC/AC PWM techniques (part II: SVM techniques)	9
DC/AC PWM techniques (part III: current control)	10
Current source inverter(part I:Basics)	11
Current source inverter(part II:PWM ,SHE)	12
Multilevel inverter(part I)	13
Multilevel inverter(part II)	14
Exam	15

University of Mosul

College of Engineering

Department: Electrical

Instructor: Dr. Mohammed Tareq

Course Title:Microelectronics

Course Code:EEE 653

Hours/ Units: 2

Level/Term: Master Program

Course Description:

The objective of the course is to provide a comprehansive understanding of basics and principles of operation of semiconductor devicesand microelectronic circuits. The involved students in this course will learn the important physical structure ,operation concepts, and models of microelectronics devices; and they will be able to describe, explain, analyze,anddesign microelectronic circuits for different applications

The course list of topics includes semiconductor devices, bipolar junction transistor, BJT amplifier, BJT diferential amplifier,BJT integrated circuits, field effect transistor, MOS field effect transistor, MOSFET amplifier, frequency response, and multistage circuits. Moreover, the students will be introduced to the important developments of future technologies of microelectronics.

The assessment in this course includeshomeworks,quizzes,midterm and final exams.

Refernces:

[1] "Microelectronics Circuit Analysis and Design", 4th Edition, by Donald Neamen.
[2] "Introduction to Solid State Physics", 8th Edition, byCharles Kittel.

Course Details:

Subject	**Week**
Overview of Microelectronics	1
Semiconductor Devices	2
Bipolar Junction Transistor (BJT) ,amplifier, and circuits.	3
The BJT differential amplifier	4
Small signal operation of the BJT differential amplifier.	5
The non-ideal characteristics of the differential amplifiers.	6
Biasing in BJT integrated circuits.	7
Field Effect Transistor	8
The MOSFET Amplifier	9
Midterm Exam	10
The MOSFET switch	11
The MOSFET unity-gain frequency	12
The MOS differential amplifiers	13
Frequency Response	14
Future Trends in Microelectronics Technologies	15

University of Mosul

College of Engineering

Department: Electrical

Instructor: Dr. Omar Sh. Yehya

Course Title: Modeling and Simulation

Course Code: EEP 670

Hours/ Units: 2

Level/Term: **Master Students**

Course Description:

In this course, the students will learn more about modeling and simulation. Furthermore, the student will know the simulation techniques and modeling concepts. Different types of software will be presented in front of students to be familiar with working on it during their research.

References:

1- Xue, D., & Chen, Y. (2013). System simulation techniques with MATLAB and Simulink. John Wiley & Sons.

2- Altiok, T., & Melamed, B. (2010). Simulation modeling and analysis with Arena. Elsevier.

3- Esfandiari, R. S., & Lu, B. (2018). Modeling and analysis of dynamic systems. CRC press.

4- Xue, D. (2022). Modeling and Simulation with Simulink®. In Modeling and Simulation with Simulink®. De Gruyter.

5- Lamedica, R., & Ruvio, A. (Eds.). (2021). Modeling and Simulation of Electricity Systems for Transport and Energy Storage. MDPI-Multidisciplinary Digital Publishing Institute.

Course Details:

Subject	**Week**
Introduction to Modeling and Simulation : Mathematical and Simulation Modeling	1
Simulation Software and Tools	2
Introduction to Finite Element Method (**FEM**) and Finite Element Analysis (**FEA**)	3
Sensitivity analysis, Optimization in Simulation, and Validation and Verification of simulation models.	4
Finite Element Method : Models and Analysis of Some Components in Electrical Engineering	5
Math-lab coding (m-files)	6
Exam 1	7
Intelligent system: Modeling and simulation of artificial neural networks **(ANN)**	8
Continuous-time system (**CTS**) and discrete-time system (**DTS**): Modeling of DTS. Simulation of DTS	9
PID modeling and Simulation : Speed Control of a DC Motor.	10
Modeling and Analysis of Renewable Energy Systems	11
Modeling and Simulation of Power Electronics Circuits: AC- AC , AC-DC, DC-AC and DC-DC . PWM Converter.	12
Exam 2	13
A simple model using SiMetrix simulator. A simple model using NS3 simulator. A simple model using an ADS simulator..	14
Modeling and simulation of Electric Vehicles (EV)	15

University of Mosul

College of Engineering

Department: Electrical

Instructor: Ass. Prof. Dr. Ahmed Alsammak

Lect. Dr. Wael hashem

Course Title: Power System Analysis

Course Code: EEP683

Hours/ Units: 2 / 2

Level/Term: Msc / P

Course Description:

This course focuses on construction, operation, and control of Electrical Power System. Topics discussed include Load flow, Advance short circuit analyses, power system stability, operation, and control of power system in additional to Flexible Alternating Current Transmission System (FACTS) simply refers to a combination of power electronics components with traditional power system components. They are intended to improve the power system reliability, power transfer capability, transient and dynamic stability improvements, voltage regulation etc....

References:

[1] Power System Analysis and Design, 6thEdition, J Duncan Glover and Thomas, sixth Edition, 2017.
[2] Electrical power system, Weedy and et al., fifth Edition, 2012.
[3] Modern Power System Analysis, Nagrath Kothari, Third Edition, 2003.
[4] Power System Analysis by Grainger and Stevenson, 1994.

Course Details:

Subject	Week
Introduction	1
Matrix formulation	2
Load flow study	3
Advance short circuit analysis	4
Optimum planning and economic operation of electric systems	5
Part (1): Stability of power system application in computer, Steady state, transient stability, and voltage stability	6
Part (2): Stability of power system application in computer, Steady state, transient stability, and voltage stability	7
Part (3): Stability of power system application in computer, Steady state, transient stability, and voltage stability	8
V/Q operation and control, f/P operation and control	9
Flexible AC transmission systems operation and control	10
Power quality principle and monitoring	11
Reliability of power system.	12
Project discussion	13
Monthly Exam	14
General review of previous topics with problem solving	15

University of Mosul

College of Engineering

Department: Electrical

Instructor:Dr. Dawood Najem Saleh

Course Title: Engineering Analysis

Course Code: EEE 640

Hours/ Units:2/2

Level/Term: **M.Sc/1st term**

Course Description:

Engineering analysis involves the application of scientific principles and approaches that often use mathematical modeling as a tool to reveal the physical state of an engineering system, a machine or device, or structure under study. Engineering analysis provides engineers with viable tools in their professional practice, which in general involves creating new products or engineering systems. Engineers who apply engineering analysis to these professional activities must realize that mathematical modeling is widely used as a "working tool" for their analyses, and the problems that they are required to deal with are fundamentally of a physical nature. This course includes many topics covering engineering analysis such as Vector Calculus, Linear Algebra, Application of Differential Equations, Discrete-time systems, The fast Fourier transform and Optimization.

Refernces:

1. Merle C. Potter, Engineering Analysis, Springer International Publishing AG, 2019.
2. Tai-Ran Hsu, Applied Engineering Analysis, John Wiley & Sons, 2018.
3. Glyn James, Advanced Modern Engineering Mathematics 4th Edition, Pearson Education Limited 1993, 2011

Course Details:

Subject	**Week**
Overview of Engineering Analysis	1
Vector Calculus	2
Linear Algebra and Matrices	3-5
Application of First-order Differential Equations in Engineering Analysis	6
Application of Second-order Differential Equations in Engineering Analysis	7
Mid-term Exam	8
Discrete-time systems and difference equations	9
The discrete Fourier transform	10
The fast Fourier transform	11
Optimization: Linear programming	12
Optimization: Simplex algorithm	13
Final review	14
Final Exam	15

University of Mosul

College of Engineering

Department: Electrical

Instructor: Dr.Mohammed Younis

Course Title:Digital Signal Processing

Course Code:EEE652

Hours/ Units: 2

Level/Term:

Course Description:

This course (Digital Signal Processing EEE652) provides process of measuring, manipulating or analysing information. Signals of interest include biomedical data, audio, still or moving images, radar. Filtering techniques can be crucial in revealing and interpreting information present in a signal.

Refernces:

1- **Digital Signal Processing John G. Proakis Dimitris K. Manolakis,Fourth Edition,2014.**
2- **Digital Signal Processing Fundamentals and Applications,Third EditionbyLizhe Tan and Jean Jiang. 2019.**
3- **Practical Analog and Digital Filter Design,Artech House, Inc.LesThede 2004**

Course Details:

Subject	**Week**
Review of discrete-time signals and systems, difference equation (D.E) representation.	1
Random process	2
Signal Samplingand Quantization	3&5
Time-domain representation and impulse response h(n).	6
Frequency-domain representation and frequency response $H(e^{jw})$.	7
IIR and FIR digital filter designs.	8&9
Digital filter realizations, (IIR filter structures; direct form I, direct form II, direct form II transpose, cascade structure, parallel form structure, Poly-phase and lattice structure).and FIR filter structures; direct	10&11
Discrete Fourier transform (DFT) and fast Fourier transform (FFT) algorithms with radix-2 and radix-4.	12&13
DSP chips , TMS32C6x architecture , functional units pipelining, registers,linear circular addressing modes and implementation erxaple	14
Examination	15

University of Mosul

College of Engineering

Department: Electrical

Instructor:Dr. Mohammed Ali Al-Rawi

Course Title: A.C. Machines

Course Code: EEP669

Hours/ Units: 2

Level/Term:MSc./1

Course Description:

A.C. machines course in M.Sc. program reviews the generalized theory of electrical machines . presents the techniques of analysis and the basic concepts of the electrical machines design. It also defines some aspect of speed control methods of varies , In spite of that it includes of dynamic and transients analysis of then (machines) more over time and space harmonics and their effects on electrical machines have been also covered. Finally this course focuses also on some special machines

Refernces:

1. **Electrical Machines**
   by S.K.Sahdev
2. **The Induction Machines Handbook**
   by Ion Boldea & Syed A.Nasar
3. **Electric Machinery and Tranformers**
   by BHAG S.GURU & Huseyin R. Hiziroglu

Course Details:

Subject	Week
Generalised theory of Electrical machines	1
Dynamics of D.C machines part 1	2
Dynamics of D.C machines. Part 2	3
Transients and dynamics of IM .	4
Transients and dynamics of IG	5
Transients and dynamics of Synch. M .	6
Transients and dynamics of Synch. G .	7
Time and Space Harmonics in AC machines.	8
The effects of Harmonics on the machines.	9
De-rating and reducing of Harmonics	10
Behaviour of AC machines under variable frequency.	11
Brushless excitation systems of synchronous machines.	12
Two phase control motor+ Electtostatic machines.	13
High voltage machines.	14
Exam	15

University of Mosul

College of Engineering

Department: Electrical Engineering

Instructor: Asst. Prof. Dr. Mohammed Obaid Mustafa

Course Title: Modern Control Theory

Course Code : EEE 647

Hours/ Units: 2

Level/Term:

Course Description:
The course of Modern Control Theory considers discrete-time models and their analysis using the z-transform. Also the course presentd stability and Design of Digital control system,

Refernces:
1- Discrete Time Control Systems" by Ogata. **2- Digital Control Engineering Analysis and Design, 2nd edition, M. Sami Fadali & Antonio Visioli, 2009**

Course Details:

Subject	**Week**
Review of State space modelling of dynamical systems - applications and examples	1
Review of Design of control system, Lead-Lag and PID , State feedback control design and Observer design	2
Introduction to Digital control system, review of Z- Transforms	3
Impulse sampling and Hold, ZOH	4
State space of Discrete time systems	5
Stability of Digital Control Systems, Routh-Hurwitz criterion, Jury test	6&7
Transient and steady state response analysis in Discrete time systems	8&9
Design based on Root Locus Method	10 &11
Design of Digital control system, Lead-Lag and PID	12&13
Liapunov Stability analysis	14
Pole Placement and Observer Design	15

University of Mosul

College of Engineering

Department: Electrical

Instructor:Ass. Prof. Dr. Yessar Ezzaldeen

Course Title: Antennas and Wave Propagation

Course Code: EEE644

Hours/ Units: 2 / 2

Level/Term: Msc

Course Description:

Antennas and propagation effects play a crucial, even though often overlooked, role in RF systems. In practice, the design of a working system such as mobile phone networks, WiFi, RFID, Satellite communication and GPS requires a good understanding of these components. This course teaches the fundamentals of antenna and propagation and shows the application in practical examples. The course covers the theory of radiation, fundamental antenna parameters and concepts, wire antennas such as dipoles and loop antennas, antenna arrays, aperture antennas, microstrip antennas. The course also learns the various propagation mechanisms/impairments and the basic models of propagation. Atmospheric and weather effects are also reviewed.

References:1- Antenna Theory: Analysis and Design', 4th Edition, by Constantine A. Balanis, Wiley, 2016

2. Introduction to RF propagation', by John S. Seybold, Wiley, 2005

Course Details:

Subject	Week
Antenna Parameters :(Radiation Pattern, Radiation Power Density, Radiation Intensity, Beamwidth, Directivity, Antenna Efficiency, Bandwith, Input Impedance, Effective Area, Friis Transmission).	1
Linear Wire Antennas: (Infinitesimal Dipole, Small Dipoles).	2
Linear Wire Antennas: (Finite Length Dipoles, Horizontal Dipole, Ground Effect).	3
Loop Antennas: (Small Circular Loop, Circular Loop of Constant Current, Ferrite Loop).	4
Antenna Arrays: (Two Element Array, N- Element Linear Array, Directivity of N- Element Array).	5
Antenna Arrays: (Three Dimensional Characteristics of N- Element, Linear Array).	6
Antenna Arrays: (Non uniform N- Element Linear Array, Planar Array).	7
Broadband Antennas: (	8
Aperture Antennas: (Radiation Equations, Rectangular Aperture, Directivity of Rectangular Aperture.)	9
Microstrip Antennas: (Characteristics, Feeding Methods, Rectangular Patch Microstrip Antenna).	10
Microstrip Antennas: (Modeling of Rectangular Patch Microstrip Antenna, Transmission- Line Model, Cavity Model).	11
Wave Propagation:(Propagation of radio waves, mode of propagation Ground wave propagation- Attenuation characteristics for ground wave propagation, Calculation of field strength at a distance.	12
Wave Propagation:(Sky wave propagation-atmospheric effects, structure of ionosphere, and its effect on radio waves. Ray path, ionospheric propagation, skip distance, virtual height, critical frequency, MUF, fading, diversity.	13
Wave Propagation: (Space wave propagation - Reflection from ground for vertically and horizontally polarized waves. Reflection characteristics of earth. Resultant of direct and reflected ray at the receiver. Duct propagation).	14
Wave Propagation:(Mobile Radio Wave Propagation Models).	15