University of Mosul

College of Engineering

Department of Electrical Engineering

Postgraduate studies

PHD – Second Semester

2023-2024

Department of Electrical Engineering

University of Mosul

College of Engineering

Department: Electrical

Instructor: Dr. Abdul Ghani A.A.

Course Title: Modern Protection Systems

Course Code: EED704

Hours/ Units: 2

Level/ Term: Ph.D./1

Course Description:

This course reviews the basic concepts of modern protection systems, and presents the contemporary concepts and techniques for protection design, analysis and control principle of digital protection, control devices, adaptive protection system, recent advances, relays and setting. assignments focus self-study and writing reports considering new protection circuits or methods. By the end of the course, student should be able to:

1-Identify the contemporary modern relays.

2- Analyze and design of digital protection.

3- Describe of the recent advances in relays.

4- Software relay setting.

5- Processer based O.C relay, distance relay, and micro process.

6- Design of an automatic load shedding.

7- Describe of auto closer.

References:

1- "Transmission Network Protection – Yeshwant" G. Paithankar

2- "Protection of Electricity Distribution Networks" by Juan M. Gers, Edward J. Holmes

Course Details:

Subject	Week
Introduction to digital protection	1
Design of digital protection	2
Recent advances and futuristic	3
Relays based on traveling waves	4
Relays based on statistical nature of noise	5
Software for relay setting	6
Processer based DC and distance relays	7
Load shedding	8
Design of an automatic load shedding system	9
Criteria for setting frequency relays	10
Auto recloser	11
Carrier coupling	12
Protection of industrial system	13
Protection schemes and substation design diagram	14

University of Mosul

College of Engineering

Department of Electrical Engineering

Instructor:

Course Title: Advanced Microprocessors

Course Code:

Hours/ Units: 2

Level/Term: **PhD Program**

Course Description:

The objective of this course is to provide a comprehensive understanding of basics, principles, operation, and applications of advanced microprocessors. Students in this course will learn the advanced microprocessor architectures, their design methodologies, and optimization techniques. They will be able to describe and explain microprocessors operation and design different applications using them.

The course list of topics includes introduction to advanced microprocessors, instruction set architectures, superscalar architectures, very long instruction word (VLIW) architectures, out-of-order execution, speculative execution, memory hierarchy design, advanced pipelining architectures, single instruction-multiple data (SIMD) architectures, energy efficient microprocessor architectures, and advanced microprocessors applications. Students will be introduced to the importance of future technologies of advanced microprocessors.

The assessment in this course includes homeworks, quizzes, seminars, midterm and final exams.

Refernces:

[1] "Advanced microprocessors and peripherals", 3rd Edition, by bhurchandi,& K. Ray.

[2] " Computer Organization and Design: The Hardware/Software", 5th Edition, by David A. Patterson,, & John L. Hennessy.

Course Details:

Subject	**Week**
Introduction to advanced microprocessors	1
Importance of advanced microprocessors	2
Instruction set architectures (ISAs)	3
Superscalar architectures	4
Very long instruction word (VLIW) architectures	5
Out-of-order execution design	6
Speculative execution design	7
Memory hierarchy design	8
Cache memory design	9
Midterm Exam	10
Advanced pipelining architectures	11
Single instruction-multiple data (SIMD) architectures	12
Energy efficient microprocessor architectures	13
Advanced microprocessors applications	14
Future trends in advanced microprocessors	15

University of Mosul

College of Engineering

Department: Electrical

Instructor:Ass. Prof. Dr. Ahmed Alsammak

Course Title:Advanced Modeling & Simulation

Course Code:EED701

Hours/ Units: 2 / 2

Level/Term:PhD

Course Description:

This course is an introductory course for AdvancedModeling and Simulationbased on Matlab. The main goal of the course is to provide students with advance tools in modeling, analysis, and design for operation, measurement, control, and optimization. The analysis in this course includes modeling and simulation foe any electrical system and simulation initial condition and parameter setting. Students will also learn how to apply the theory to engineering problems with MATLAB. The course will cover both continuous-time and discrete-time systems, as well as both time-invariant and time-varying systems. Simple examples from electrical engineering will be used. This course will give the advanceintelligent control and optimization.

References:

[1]Environmental Systems Analysis with MATLAB®, MarsiliLibelli, Stefano, 2016.

[2]Automatic Control Systems, Farid Golnaraghi and Benjamin Kuo, 9th Edition, 2010.

[3]Intelligent Hybrid Systems Fuzzy Logic, Neural Networks, and Genetic Algorithms by Hideyuki Takagi, 1997.

[4] Matlab documents, Particle Swarm Optimization (PSO) - GUI Simulator, 2022.

Course Details:

Subject	Week
Introduction, simulation techniques, modeling concepts, computer techniques for modeling and simulation,Continuous-time system (CTS) and discrete-time system (DTS),	1
MATLAB simulation parameters.	2
Modeling and simulation of intelligent systems: Definitions and examples.	3
Modeling of biological neural node and network, Simulation of artificial neural networks using MATLAB software.	4
Fuzzy control systems, theory, and applications.	5
Modeling and simulation of a fuzzy control system using MATLAB software.	6
PID Auto tuner based fuzzy controller.	7
Tuning Fuzzy Inference Systemsand Tune Mamdani Fuzzy Inference System	8
Optimization, Swarm Intelligent_PSO	9
Fuzzy Clustering	10
Adaptive neuro-fuzzy inference system (ANFIS), Neuro-Fuzzy Designer.	11

ANFIS applications in power, machines, electronics, and communication engineering systems.	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. Mohammed Younis

Course Title: Computer Network Security

Course Code: EED717

Hours/ Units: 2

Level/Term: 2

Course Description:

This course provides students with basic knowledge in:

Basic concepts of network security; History of encryption techniques; AES symmetric encryption technique; public-key encryption and RSA; Message Authentication and Hash Functions; Authentication Protocols; Cryptographic Systems: Secure Socket Layer (SSL), Virtual Private Network (VPN), and Kerberos; Access Control of Computer Resources; Computer Viruses, Malicious and Antivirus Software; Network Security Tools: Firewall, Intrusion Detection System (IDS) and Intrusion Prevision System (IPS); Web Security, Email Security and Password Management; and Security of Wireless Networks.

Refernces:

1- **Cryptography and network SeCurity PrinciPles and Practice Sixth edition William Stallings.**
2- **Network Security eSSeNtialS: Applications and Standards Sixth edition Global edition.**
3- **Computer Security *Principles and Practice* Fourth Edition Global Edition William Stallings Lawrie Brown.**

Course Details:

Subject	Week
Basic Concepts of Network Security	Week 2
History of Encryption Techniques	Week 3
Symmetric Encryption Technique and AES	Week 4
Public-Key Encryption Techniques and RSA	Week 5
Message Authentication and Hash Functions	Week 6
Authentication Protocols & Cryptographic Systems: Secure Socket Layer (SSL), Virtu	Week 7
Computer Viruses, Malicious and Antivirus Software	Week 8
Firewall Architecture and Administration	Week 9
Intrusion Detection System (IDS) and Intrusion Prevision System (IPS)	Week 10
Web Security, Email Security and Password Management	Week 11
Security of Wireless Networks	Week 12
Access Control Techniques of Computer Resources	Week 13

University of Mosul

College of Engineering

Department: Electrical

Instructor: Dr. Omar Sh. Yehya

Course Title: Research Methodology

Course Code:

Hours/ Units: 1

Level/Term: PhD Students

Course Description:
In this course, the students will learn more about scientific research and clarification of some research components. Furthermore, the category of journals and conferences. Literature Review and how to write a scientific Research Proposal. How to write scientific papers. As well as More information will be presented in front of students to be familiar with working on it during their research.
References:
1- "Research Methods in Education" by Louis Cohen, Lawrence Manion, and Keith Morrison (2017) 2- "The Oxford Handbook of Multimethod and Mixed Methods Research Inquiry" edited by Sharlene Nagy Hesse-Biber and R. Burke Johnson (2018) 3- "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell and J. David Creswell (2017) 4- Pandey, P., & Pandey, M. M. (2021). Research methodology tools and techniques. Bridge Center.
Course Details:

Subject	**Week**
Introduction to Research Methodology	1
Philosophical Foundations of Research	2
Research Design and Planning	3
Literature Review and Theoretical Framework	4
Research Proposal	5
Research Defense and Presentation	6
Exam 1	7
Research Validity and Reliability	8
Data Collection and Management	9
Scientific websites and Indexing issues : SJR, JCR, WOS and Impact Factor, H- Index	10
Research Ethics : Plagiarism issue	11
How to choose the right journal: Type of Conferences, Type of Journals	12
Exam 2	13
Software for the arrangement of the references	14
How to write your paper , thesis and How to Pass your Viva	15

University of Mosul

College of Engineering

Department: Electrical

Instructor: Dr. Omar Sh. Yehya

Course Title:Smart Grids and Renewable Energy

Course Code:EED711

Hours/ Units: 2

Level/Term:PhD Students

Course Description:

In this course, the students will learn more about Smart Grids and Renewable Energy. As well as more information will have presented in front of students to be familiar to work on it during their research.

References:

1- Smart Grid Applications, Communications, and Security"** edited by Lars T. Berger, Mohamed E. El-Hawary (2014)
2- Hatti, M. (Ed.). (2019). Smart Energy Empowerment in Smart and Resilient Cities: Renewable Energy for Smart and Sustainable Cities (Vol. 102). Springer Nature.
3- Littlewood, J., Spataru, C., Howlett, R. J., & Jain, L. C. (Eds.). (2017). Smart Energy Control Systems for Sustainable Buildings (Vol. 67). Springer.
4- Renewable Energy Integration: Practical Management of Variability, Uncertainty, and Flexibility in Power Grids"** by Lawrence E. Jones (2014).
5- Kumar, B. V., Sivakumar, P., Singaravel, M. R., &Vijayakumar, K. (2021). Intelligent Paradigms for Smart Grid and Renewable Energy Systems. Springer.
6- Tripathy, B. K., &Anuradha, J. (Eds.). (2017). Internet of things (IoT): technologies, applications, challenges and solutions. CRC press.
7- "Smart Grid Handbook" edited by Chen-Ching Liu, Stephen McArthur (2016)

Course Details:

Subject	Week
Definition of Smart Grid and Renewable Energy	1
Distributed Energy Resources Integration	2
Smart grid infrastructure and technologies	3
Smart Grid and Renewable Energy technical issues and challenges	4
Intelligent Grid definition and Smart Meter	5
Smart Building and Zero Energy Building	6
Exam 1	7
Advance Grid Control and Energy management System	8
Virtual Power Plant (**VPP**)	9
Energy Audit	10
Smart grid and demand-side Management integration with renewable energy.	11
Internet of Things (**IoT**) for smart grid applications	12
Exam 2	13
Communication and Networking in Smart Grids Micro-Grid and Islanding	14
Microgrid and Islanding	15

University of Mosul

College of Engineering

Department: Electrical

Instructor:Ass. Prof. Dr. Yessar Ezzaldeen

Course Title: Wave Propagation

Course Code: EED718

Hours/ Units: 2 / 2

Level/Term: PhD

Course Description:
The course covers radio waves in the frequency range above about 2 MHz. The radio wave propagation covers free space, reflection, transmission through materials, diffraction, effects by atmospheric gases, hydrometeor precipitation, and abnormal air mixture such as inversion layers, system dimensioning, and radio channel models. The course also learns the various propagation mechanisms/impairments and the basic models of propagation. Atmospheric and weather effects are also reviewed. The course emphasizes topics that are important for actual radio systems such as mobile and broadband communication.
References: 1- Antenna and wave propagation by K.D. Prasad 2- Introduction to RF Propagation by John. S Seybold 3-Radio Wave Propagation and Antennas for Personal Communications by Kazimierz Siwiak.
Course Details:

Subject	**Week**
Modes of Propagation: (Ground Wave Propagation, Sky Wave Propagation, Space Wave Propagation, Tropospheric Scatter Propagation)	1&2
Sky Wave Propagation: (Propagation of Radio Wave Through the Ionosphere, Effect of Earth's Magnetic Field on ionosphere Radio Wave Propagation, Effect of Dielectric Constant and Conductivity).	3&4
Ionosphere Abnormalities: (Ionospheric Storms, Tides and Winds, Fading, …….etc)	5
Radio Wave Propagation: (Ionospheric Absorption, Multi-Hop Propagation, Duct Propagation).	6
Atmospheric Effects: (Atmospheric Refraction, Atmospheric Attenuation, Loss from Moisture and Precipitation).	7&8
Cross-Polarization Induced by the Atmosphere.	9
Fading and Multipath Characteristics: (Ground Bounce Multipath, Small Scale Fading, Large scale Fading).	10&11
Rain Attenuation: (Specific Attenuation due to Rainfall).	12
Propagation Models: (Foliage Model, Terrain Modeling, Propagation in Built- UpAreas)	13&14
Indoor Propagation Modeling: (Indoor Propagation Effect, Indoor Modeling).	15

University of Mosul

College of Engineering

Department: Electrical

Instructor:Dr. M. Ali Al-Rawi

Course Title: Advanced Alternating Machines

Course Code: EE768

Hours/ Units: 2

Level/Term:Ph.D./1

Course Description:

The program contains and involves the approaches that use analysis of different electrical machines (Induction and synchronous) towards mathematical modeling and simulation cases of transient and steady state operations of above machines .
In addition the distribution of electromagnetic flux (field) in the air gap is also included in this program . moreover single and three phase motors and generators parameters effects on performances , characteristics , properties on them have been covered and studied.

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
4. **Alternating Current Machines**
   by M.G.SAY

Course Details:

Subject	Week
Three - phase lnduction machines part 1	1
Three - phase Induction machines part 2	2
Single – phase Induction machines part 1	3
Single – phase Induction machines part 2	4
Induction machines operating modes	5
Induction machines Speed control	6
Self excited induction generators	7
Synchronous machines part 1	8
Synchronous machines part 2	9
Synchronous Generators.	10
De-rating of three- phase induction motor.	11
AC commutator machines.	12
Regenerative Systems.	13
High performance drives.	14
Space and Time Harmonics & Exam	15