Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK509-2023	Adaptive Control Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK509-2023	Adaptive Control Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
This course provides knowledge on the general principles of adaptive control. It also provides information for existing algorithms for adaptive control. In this course, the basic concepts and adaptive control terminology are covered at the institute level.
Teaching Methods and Techniques:
Mathematical Preliminaries: Vector, Matrix, Series and convergence, Laplace Transformation, Matrix.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Gürkan KAVURAN
Assistants:

Recommended or Required Reading

Resources

1. Adaptive Control, Addison , K. J. Acstrom, B. Wittenmark, -Wesley, 1995. 2. Self-tuning Systems; Control and Signal Processing, P.E. Wellstead, M.B: Zarrap, Wiley, 19
1. Adaptive Control, Addison , K. J. Acstrom, B. Wittenmark, -Wesley, 1995.
2. Self-tuning Systems; Control and Signal Processing, P.E. Wellstead, M.B: Zarrap,
Wiley, 1991.

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Mathematical Preliminaries: Vector, Matrix, Series, and Convergence.		
2	Laplace Transform		
3	Matrix and Vector Norms		
4	Introduction to Adaptive Control Systems		
5	Model Reference Adaptive Control Systems		
6	Self-tuning Regulators		
7	Automatic Tuning		
8	Midterm Exam		
9	Gain Scheduling		
10	Hyperstability		
11	Adaptive Control of Robotic Arms		
12	Adaptive Control of Multirotor Aerial Vehicles		
13	Adaptive Control of Multirotor Aerial Vehicles		
14	Image Processing Supported Adaptive Control Applications		
15	Image Processing Supported Adaptive Control Applications	-	-
16	Final Exam	-	-

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Students - Demonstrates knowledge of adaptive control concepts. - Adaptive controller can use standard methods for design and analysis, -Review the literature on this subject can study and condu
C02	Students can design adaptive controllers for nonlinear systems
C03	Students understand the concept of hyperstability
C04	Students can analyze the stability of adaptive control systems using Lyapunov stability theory and derive controller parameter adaptation laws.
C05	Students design adaptive controllers for different dynamic systems using Model Reference Adaptive Control (MRAC) and Self-Tuning Regulator (STR) methods and evaluate their performance.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%15
Quizzes	0	%0
Assignment	1	%15
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	10	140
Assignments	1	7	7
Presentation	1	7	7
Mid-terms	1	15	15
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	15	15
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

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	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	3	4	5	5	2	5	5	2	2	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK507-2023	Smart Grids				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK507-2023	Smart Grids	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to provide students with an understanding of the structure, control, and monitoring of smart grids; and to enable them to solve problems related to renewable energy integration, energy storage, communication systems, cybersecurity, and the integration of advanced control systems into power networks.
Teaching Methods and Techniques:
Introduction to smart grid, integration of renewable energy, energy storage, demand side management, communication, measurement and control in smart grids, cyber security, data privacy, distributed sensing and control, large area measurements, electric vehicles in power systems, system reliability and auxiliary services, micro network analysis.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Kadir Doğanşahin
Assistants:

Recommended or Required Reading

Resources
Ali Keyhani, "Smart Power Grid Renewable Energy Systems," Wiley.
James Momoh, Smart Grid Fundamentals of Design and Analysis, Wiley.
Yenilenebilir Enerji Sistemlerinde Akıllı Şebeke Tasarımı, Ali Keyhani.

Course Category

Mathmatics and Basic Sciences	:	30	**Education**	:	
Engineering	:	50	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Electrical power networks, basic concepts, operation of traditional networks and problems		
2	Smart grid terms: from traditional grids to smart grids		
3	Microgrid structures		
4	Control and monitoring of microgrid systems		
5	Short and medium distance communication systems, wireless sensor networks in smart grids		
6	Production systems in smart grids, distributed generation, virtual power plants		
7	Integration of renewable energy sources into the traditional electricity grid and problems		
8	Midterm Exam		
9	Integration of renewable energy sources into the traditional electricity grid and its problems		
10	Smart grids in energy storage systems		
11	Integration of loads with dynamic demand response		
12	Dynamic stability analyzes of smart grids		
13	Voltage and frequency stability in smart grids		
14	Integration of current frequency control systems in smart grids		
15	Cybersecurity in smart grids		
16	Final Exam		

Recommended Optional Programme Components

ELK105-2023 Advanced Engineering Mathematics
ELK525-2023 Measurement and Instrumentation in Electrical Systems

Course Learning Outcomes

No	Learning Outcomes
C01	Understands the fundamental elements of a smart grid. Provides a connection with the fundamental elements of traditional electric power grids.
C02	Analyzes smart grid architectures and components.
C03	Performs technical and economic analyses on electrical networks and interprets the outputs.
C04	Produces solutions for communication and control methods used in smart grids, cyber security and data privacy issues.
C05	Knows the area where research on the subject is concentrated in current literature

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%25
Quizzes	0	%0
Assignment	4	%15
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%60
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	5	70
Assignments	4	10	40
Presentation	0	0	0
Mid-terms	1	24	24
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	48	48
Total Work Load			**224**
ECTS Credit of the Course			**7**

Contribution of Learning Outcomes to Programme Outcomes

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	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
C01	4	4	3	3	3	4	3	3	3	4
C02	4	5	4	4	4	5	4	3	4	4
C03	4	5	4	4	4	4	5	4	4	4
C04	3	4	4	4	4	4	5	4	4	5
C05	4	4	4	5	5	4	5	4	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK533-2023	Analysis of Active Electronic Circuits				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK533-2023	Analysis of Active Electronic Circuits	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
Basic blocks used in active filter implementation. Structures used in active filter implementation. Second order active filter design criteria. Highly active filter design criteria.
Teaching Methods and Techniques:
Circuit functions, frequency and impedance normalization, filter types, approximation problem, a brief overview of passive circuit synthesis, synthesis of cascade-type LC circuits. Basic active circuit synthesis blocks. Operational amplifier, Operational transconductance amplifier (OTA), Basic integrators containing second generation current carriers (CCII), gyrator and immittance converters, second order filters, circuits containing OTA, non-ideal effects. Higher-order filter implementation, cascade coupling, zero-pole matching, multi-feedback structures, implementation of cascade-type LC circuits with active circuits, fully integrated high-frequency implementations, transconductance amplifiers, switched capacitance circuits
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Mehmet Üstündağ
Assistants:

Recommended or Required Reading

Resources

Schaumann R., Valkenburg M.A.V. (2001). Design of Analog Filters. Oxford University Press. Huelsman L.P. (1993) Active and passive analog filter design: an introduction
Schaumann R., Valkenburg M.A.V. (2001). Design of Analog Filters. Oxford University Press. Huelsman
L.P. (1993) Active and passive analog filter design: an introduction. Mcgraw-Hill inc., International Editions.

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	50	**Science**	:	
Engineering Design	:	30	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Linear time-invariant systems, transfer function, amplitude, phasefunction, group delay concepts.	Reading source material and review	Recommended resources
2	Concept of sensitivity; relative, semi-relative, absolute precision,precision invariants.	Reading source material and review	Recommended resources
3	Approximation problem, basic approximations: Butterworth,Chebyshev approximations.	Reading source material and review	Recommended resources
4	Basic active filter circuit structures.	Reading source material and review	Recommended resources
5	Basic active filter circuit structures, high frequency limitations.	Reading source material and review	Recommended resources
6	Basic filter configurations: Second order filters.	Reading source material and review	Recommended resources
7	Filter bandwidth-instability problem of second order filters.	Reading source material and review	Recommended resources
8	MIDTERM EXAM		
9	Topic repetitions and Matlab Application	Reading source material and review	Recommended resources
10	Balanced and Fully integrable filters: Second order filters.	Reading source material and review	Recommended resources
11	OPAMP-RC filter synthesis of cascade type: Higher order filters.	Reading source material and review	Recommended resources
12	OTA-C filter synthesis of cascade type: Higher order filters.	Reading source material and review	Recommended resources
13	Balanced filter structures: High order filters.	Reading source material and review	Recommended resources
14	Cascading: High order filters.	Reading source material and review	Recommended resources
15	Switched capacitance filters- Second order filters.	Reading source material and review	Recommended resources
16	FINAL EXAM		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	It analyzes the transfer functions of linear time-invariant circuits.
C02	It compares Butterworth and Chebyshev filter approaches in terms of the given design criteria.
C03	Calculates the pole frequency and quality factor of second-order active filters.
C04	Designs an op-amp-based active filter according to the given frequency response criteria.
C05	It evaluates the non-ideal effects of OTA- and current-conveyor-based filters.
C06	Compares cascade and stepwise rendering options of higher order filters.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	11	154
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	10	10
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	19	19
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

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	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	1	3	4	4	1	2	2	1	1	1
C01	1	3	3	4	1	2	2	1	1	1
C02	1	3	3	5	1	2	2	1	1	1
C03	1	3	3	3	1	2	2	1	1	1
C04	1	3	5	4	1	3	2	1	1	1
C05	1	3	3	5	1	2	3	1	1	1
C06	1	3	4	5	1	2	2	1	1	1

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK500-2023	Analog Filters				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK500-2023	Analog Filters	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to introduce students to the basic filter structures used to process analog signals.
Teaching Methods and Techniques:
Basic Filter Concepts: Basic concepts such as frequency responses, transfer functions, cut-off frequencies. Low Pass Filters (LPF): Filters that pass low frequency components while cutting high frequency components. High Pass Filters (HPF): Filters that pass high frequency components while cutting low frequency components. Band Pass Filters (BPF): Filters that pass a specific range of frequencies. Band Cutting Filters (BSF): Filters that cut a specific frequency range. Filter Design and Applications: Filter design methods, implementation circuits and practical applications.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Prof. Dr. Melih Cevdet İNCE
Assistants:

Recommended or Required Reading

Resources

Dimopoulos, H. G. (2011). Analog electronic filters: theory, design and synthesis. Springer Science & Business Media.
Su, K. L. (2012). Analog filters. Springer Science & Business Media.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	15	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	25	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Basic Concepts and Frequency ResponsesBasic concepts of analog filters, frequency responses and transfer functions.Analy		
2	Passive FiltersRC, RL and RLC circuits.Frequency responses of passive filters.		
3	Basics of Active FiltersOp-amp based filters.Advantages and applications of active filters.		
4	Low Pass Filters (LPF)LPF design and Butterworth filters.Frequency responses and cutoff frequency.		
5	High Pass Filters (HPF)HPF design and Chebyshev filters.Selectivity and sharpness of filters.		
6	Band Pass Filters (BPF)BPF design and Bessel filters.Bandwidth and center frequency.		
7	Band Cutting Filters (BSF)BSF design and elliptical filters.Usage areas of band cutter filters.		
8	Midterm Exam		
9	Filter CharacteristicsPhase and group delay responses of filters.Stability and phase margin.		
10	Filter Design SoftwareFilter design with MATLAB and other software.Simulation and analysis techniques.		
11	Noise and FiltersEffect of noise on filters.Noise reduction methods.		
12	Analog-Digital ConversionA/D and D/A conversions.Sampling theorem and aliasing.		
13	Filter ApplicationsUse of filters in communication systems.		
14	Filters in audio and video processing.		
15	Student Projects and Presentations Presentation of the filters designed by students. Project evaluation and feedback.		
16	Final Exam		

Recommended Optional Programme Components

ELK502-2023 Filter Design Methods

Course Learning Outcomes

No	Learning Outcomes
C01	Understands the fundamental design principles of low-pass, high-pass, band-pass, and band-stop filters.
C02	Gains knowledge about the frequency responses and transfer functions of analog filters.
C03	Selects and designs the appropriate type of filter for different applications.
C04	Gains the ability to design filters using MATLAB or other simulation tools.
C05	Analyzes the performance of the designed filters and interprets the results.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	15	3	45
Hours for off-the-c.r.stud	5	4	20
Assignments	5	2	10
Presentation	0	0	0
Mid-terms	1	30	30
Practice	3	4	12
Laboratory	0	0	0
Project	2	4	8
Final examination	2	50	100
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	3	4	3	4	3	3	2	4
C01	5	4	3	4	3	4	3	3	2	4
C02	5	4	3	4	3	4	3	3	2	4
C03	5	5	4	4	3	5	4	3	3	5
C04	5	5	4	4	3	5	4	3	3	5
C05	5	5	4	5	3	5	5	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK104-2023	Scientific Research Techniques and Publication Ethics				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK104-2023	Scientific Research Techniques and Publication Ethics	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Required
Objectives of the Course:
Being able to know how the process in a scientific research works and how a scientific report should be prepared.
Teaching Methods and Techniques:
Basic concepts and information about science, structure of scientific research, scientific methods and different views on these methods, problem, research model, universe and sample, collection of data and data collection methods (quantitative and qualitative data collection techniques), recording and analysis of data, interpretation and reporting.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Prof. Dr. Melih Cevdet İNCE
Assistants:

Recommended or Required Reading

Resources

Karasar, N. (2001). Report Preparation in Research. Ankara: Nobel Publishing Distribution. Academic Writing Rules Booklet. http://sbe.baskent.edu.tr/akademik.pdf
Karasar, N. (2003). Scientific Research Method. Ankara: Nobel Publishing Distribution.
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Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	**Education**	: 40
Engineering	: 30	**Science**	:
Engineering Design	:	**Health**	:
Social Sciences	: 30	**Field**	:

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Basic concepts, principles and approaches		
2	Source of information; science, scientific method		
3	Research and research education		
4	Research processes and techniques / Report preparation techniques		
5	Ways of Citing and Citing References		
6	Purpose and Sub-Objectives; importance, assumptions, limitations and definitions.		
7	Practice or Topic Review		
8	Midterm		
9	Data and data collection techniques		
10	Processing and analysis of data		
11	Findings and interpretation		
12	Prepare a sample report		
13	Prepare a sample report		
14	Evaluation of reports		
15	Evaluation of reports		
16	Final Exam		

Course Learning Outcomes

No	Learning Outcomes
C01	Gains knowledge about the scientific research process.
C02	Writes a research proposal related to their field.
C03	Becomes familiar with data collection and analysis methods.
C04	Gains knowledge about how to present their findings.
C05	Gains knowledge about interpreting findings and making recommendations.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	41	41
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	3	4	3	3	4	3	2	4
C01	4	4	3	4	3	3	4	3	2	4
C02	4	4	4	4	3	3	4	3	3	4
C03	4	4	3	4	3	3	4	3	3	4
C04	4	3	3	3	4	3	3	3	3	4
C05	4	4	3	4	4	3	4	3	3	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK515-2023	Fuzzy Logic				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK515-2023	Fuzzy Logic	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
Fuzzy logic definitions and concepts. Implementation of the applications.
Teaching Methods and Techniques:
Fuzzy sets, membership functions, fuzzy propositions, fuzzy models, fuzzy values, fuzzy quantifiers, conditional and constrained fuzzy propositions, conditional and constrained fuzzy propositions inferences, fuzzy set operations, extended fuzzy sets, fuzzy relation equations, rule base inference, blurring, inference mechanisms, clarification, mamdani and sugeno fuzzy system models, fuzzy relations, fuzzy functions, sample applications.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Deniz Korkmaz
Assistants:

Recommended or Required Reading

Resources
Fuzzy Sets and Fuzzy Logic: Theory and Applications
Bulanık Mantık Lecturer Notes
Bulanık Mantık Ders Notları, Fuzzy Sets and Fuzzy Logic: Theory and Applications
Bulanık Mantık Kontrolör Tasarımı
Ara Sınav ve Yarıyıl Sonu Sınavı

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	30	**Science**	:	
Engineering Design	:	50	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Fuzzy sets, membership functions	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
2	Fuzzy propositions, fuzzy models,	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
3	Fuzzy values, fuzzy quantifiers,	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
4	Conditional and constrained fuzzy propositions,	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
5	Fuzzy set operations	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
6	Extended fuzzy sets,	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
7	Fuzzy relation equations	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
8	Midterm Exam		
9	Rule base inference, blurring,	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
10	Inference mechanisms,	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
11	Clarification	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
12	Mamdani and sugeno fuzzy system models,	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
13	Fuzzy relations	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
14	Fuzzy functions	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
15	Sample applications.	Repeating and preparing with lecture no	1- Fuzzy Logic Lecture Notes 2- Fuzzy Se
16	Final Exam		

Course Learning Outcomes

No	Learning Outcomes
C01	Students explain the differences between classical sets and fuzzy sets.
C02	Students perform set operations on fuzzy sets.
C03	Students perform arithmetic operations with fuzzy numbers.
C04	Students gain the ability to solve problems using linguistic variables.
C05	Students interpret systems involving fuzziness.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	41	41
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	3	5	3	4	3	3	2	4
C01	4	4	3	5	3	4	3	3	2	4
C02	4	4	3	4	3	5	4	3	2	4
C03	4	4	3	4	3	5	4	3	2	4
C04	4	5	4	4	3	5	4	3	3	5
C05	4	5	4	5	4	4	4	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK512-2023	Control of Multi-RotorAircraft				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK512-2023	Control of Multi-RotorAircraft	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to provide students with the knowledge of multi-rotor aircraft (e.g. multicopters and drones) by teaching control systems and flight principles, the design of these technologies, To provide competence in control and applications.
Teaching Methods and Techniques:
This course progresses from the basics of automatic control systems. control loop and The differences between open loop and closed loop control are examined by introducing the components. Mathematical modeling of dynamic systems using Laplace transforms and stability analysis is performed. Stability of control systems with the Routh-Hurwitz criterion is evaluated. Then, mathematical models of twin-rotor and quad-rotor aircraft and control methods are discussed. Computer simulations and real-time applications It provides students with practical experience.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Gürkan Kavuran
Assistants:

Recommended or Required Reading

Resources

1. QUANSER, 3 DOF Hover Experiment for MATLAB /Simulink Guide. 2. Feedback, Twin Rotor Mimo System – Advanced Teaching Manual 1-33-007-4M5,
1. K. Ogata, Modern Control Engineering, 5th Edition, Pearson Higher Education, (Prentice Hall)
2. J.B. Kuo, F. Golnaraghi, Automatic Control Systems, 9th Edition, Wiley
3. N.S.Nise, Control Systems Engineering, 6th Edition, Wiley
4. R.C. Dorf, Modern Control Systems, 6th Edition, Addison-Wesley

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to Automatic Control: System, control and automatic control		
2	Control loop and its components; Open-loop control and closed-loop control, open-loop and closed-advantages and disadva		
3	Laplace Transforms		
4	Mathematical Modeling of Dynamic Systems: Mechanical and electrical systems; Transfer function.		
5	Temporary and Permanent State Behavior Analysis		
6	Stability of control systems: Routh-Hurwitz Criterion.		
7	Stability of control systems: Routh-Hurwitz Criterion.		
8	Midterm Exam		
9	State Space Equations		
10	Mathematical Modeling of Twin-Rotor CGCC Air Vehicles		
11	Control Methods of Double Rotor CGCC Air Vehicles		
12	Mathematical Modeling of Quad-Rotor CGCC Air Vehicles		
13	Control Methods of Quad-Rotor CGCC Air Vehicles		
14	Simulation Studies in Computer Environment		
15	Real Time Application Studies		
16	Final Exam		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	A student who successfully completes the course understands the nature of fractional order systems.
C02	Performs numerical solutions of fractional order differential equations;
C03	Be aware of the difficulties specific to nonlinear fractional systems.
C04	Can analyze fractional systems using some techniques.
C05	Can design fractional control systems using some techniques.
C06	Will be able to follow other topics and studies related to fractional systems and controls has the infrastructure.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%15
Quizzes	0	%0
Assignment	1	%15
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	10	140
Assignments	1	7	7
Presentation	1	7	7
Mid-terms	1	15	15
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	15	15
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	3	4	5	5	2	4	4	2	2	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK520-2023	Durable Control Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK520-2023	Durable Control Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
To learn the theory and applications of robust control systems. Demonstrating the effect of disturbances and uncertainties affecting the system on system performance and stability. Designing a controller that satisfies performance constraints such as H2 and H infinite norm.
Teaching Methods and Techniques:
Basic concepts of durability and the relationship between durability and the system mathematical model, Mathematical preliminary information on the norms of vectors, matrices, signals and systems, Performance measurement with reduced norm, Robust stability and performance problems, Computer-assisted analysis methods, Optimal control design, H infinite optimal control problems, Design example.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Deniz KORKMAZ
Assistants:

Recommended or Required Reading

Resources

Robust and Optimal Control, Zhou, Doyle, Glover, Prentice Hall, 1995.
Skogestad, S., & Postlethwaite, I. (1996). Multivariable feedback control: Analysis and design. Wiley.

Dullerud, G. E., & Paganini, F. (2000). A course in robust control theory. Springer.

Doyle, J. C., Francis, B. A., & Tannenbaum, A. R. (1992). Feedback control theory. Macmillan.
Ders Kitabı, Ders Notları

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 40	**Science**	:
Engineering Design	: 40	**Health**	:
Social Sciences	:	**Field**	: 20

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to robust control		
2	Preliminary information about finite dimensional spaces		
3	Summary of state space system theory		
4	norm concept		
5	Performance limits in SISO systems		
6	Uncertainties for SISO systems		
7	Robust stability and performance analysis		
8	Midterm		
9	Controller design		
10	Robust control approaches in the frequency domain		
11	Optimization and control		
12	H2 and H infinite control		
13	Mu synthesis		
14	Design Example		
15	Design Example		
16	Final Exam		

Recommended Optional Programme Components

ELK518-2023 Robotic Systems

Course Learning Outcomes

No	Learning Outcomes
C01	Explains the fundamental concepts of robust control and its differences from classical control methods.
C02	Defines system uncertainties and analyzes their effects on system performance.
C03	Applies robust control design methods such as H-Non and μ-synthesis.
C04	Designs a robust controller and evaluates system stability.
C05	Interprets the performance of robust control strategies in real systems.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	7	98
Assignments	3	5	15
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	40	40
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	3	3	2	3	2	3	3	2	2	3
C01	4	4	3	4	3	4	4	2	3	3
C02	4	4	4	5	3	5	5	3	3	4
C03	4	4	4	5	3	5	5	3	3	4
C04	5	4	5	5	3	5	5	3	4	4
C05	5	4	4	4	4	4	4	4	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK510-2023	Nonlinear Control Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK510-2023	Nonlinear Control Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to create the necessary infrastructure to understand, analyze and control such systems. The topics to be discussed for this purpose include: the concept of nonlinear systems, their examples and distinctive features; second order systems and the state plane; Some basic properties of nonlinear state equations such as existence and uniqueness of solution; stability analyzes (Lyapunov, input-output, passivity) ; analysis in the frequency domain; Controller design methods such as feedback linearization and sliding mode control.
Teaching Methods and Techniques:
Introduction to nonlinear systems and some examples. Second order systems and the state plane. Lyapunov determination. Input and output stability. Passivity. Analysis in the frequency domain: absolute stability, circle criterion, Popov criterion, defining function method. Nonlinear control systems design: feedback linearization, sliding mode control
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Gürkan Kavuran
Assistants:

Recommended or Required Reading

Resources

1. Khalil H. K., Nonlinear Systems, 3rd Ed., Prentice Hall, 2002. 2. Slotine J. J. E. and Li W., Applied Nonlinear Control, Prentice Hall, 1991. 3. İsidori A., Nonlinear Control
1. Khalil H. K., Nonlinear Systems, 3rd Ed., Prentice Hall, 2002.
2. Slotine J. J. E. and Li W., Applied Nonlinear Control, Prentice Hall, 1991.
3. İsidori A., Nonlinear Control Systems, 3rd Ed., Springer, 1995.
4. Vidyasagar M., Nonlinear Systems Analysis, 2nd Ed., Prentice Hall, 1993.
5. Sastry S., Nonlinear Systems: Analysis, Stability and Control, Springer-Verlag, 1999.

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Nonlinear systems and features specific to such systems. Examples of nonlinear systems,Lienards equation, Van der Pol eq		
2	Second order systems and state plane, multiple equilibria.		
3	System behavior around equilibrium points, limit cycle, existence of periodic orbits, Poincare-Bendixson criterion, Bendixsor		
4	Solution of nonlinear state equations, existence and uniqueness of the solution, Lipschitz condition, initializationconstant de		
5	Lyapunov stability: autonomous (time-invariant) systems.		
6	Lyapunov stability: invariance principle, linearization and local stability, comparison functions.		
7	Lyapunov stability: non-autonomous (time-varying) systems, boundedness and strict boundedness, from the introductionde		
8	Midterm Exam		
9	Passivity.		
10	Input and output stability.	-	-
11	Frequency domain analysis of feedback systems: absolute stability, circle criterion, Popov criterion.		
12	Frequency domain analysis of feedback systems: defining function method.		
13	Feedback linearization.		
14	Sliding mode control.		
15	Sliding mode control.	-	-
16	Final Exam	-	-

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	A student who successfully completes the course understands the nature of nonlinear systems.
C02	Be aware of the difficulties specific to nonlinear systems.
C03	Can analyze nonlinear systems using some techniques.
C04	Can design nonlinear control systems using some techniques.
C05	Have the infrastructure to follow other topics and studies related to nonlinear systems and their controls.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%15
Quizzes	0	%0
Assignment	1	%15
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	10	140
Assignments	1	7	7
Presentation	1	7	7
Mid-terms	1	15	15
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	15	15
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	3	4	5	5	2	4	4	2	2	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK527-2023	Design of Electrical Machines				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK527-2023	Design of Electrical Machines	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
This course provides information on the design principles of electrical machines.
Teaching Methods and Techniques:
Induction motors, permanent magnet synchronous motors and generators; electric and magnetic loads, winding types, magnetic circuits, main flux paths using magnetic circuits calculation, leakage flux calculations, calculation of all losses
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Emrullah AYDIN
Assistants:

Recommended or Required Reading

Resources

Fitzgerald, A. E., Charles, K., & Umans, S. D. (2013). Electric machinery. McGraw-Hill Education.
Lipo, T. A. (2017). Introduction to AC machine design. Wiley.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	induction motors		
2	Permanent magnets; Characteristics and types		
3	Permanent magnet synchronous motors		
4	Permanent magnet synchronous generators		
5	Brushless DC motors		
6	Axial flux motors		
7	Basic principles in transformer design		
8	MIDTERM		
9	Electric and magnetic charges		
10	Winding types		
11	Magnetic circuits		
12	Calculation of main flux paths using magnetic circuits		
13	Calculation of main flux paths using magnetic circuits		
14	Torque fluctuations and minimization in electric motors		
15	Efficiency analysis and optimization methods in electrical machines		
16	SEMESTER FINAL EXAM		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Learns the operating principles of basic and special electrical machines, the design parameters, and how they can be optimized.
C02	Designs an electrical machine.
C03	Derives the magnetic equivalent circuit.
C04	Analyzes and evaluates the performance of electrical machines.
C05	Interprets the behavior of electrical machines under different operating conditions.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	15	3	45
Hours for off-the-c.r.stud	5	4	20
Assignments	5	2	10
Presentation	0	0	0
Mid-terms	1	30	30
Practice	3	4	12
Laboratory	0	0	0
Project	2	4	8
Final examination	2	50	100
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	4	4	3	5	4	3	3	4
C01	5	4	4	4	3	5	4	3	3	4
C02	5	5	5	4	3	5	4	3	4	4
C03	4	4	4	4	3	5	4	3	3	4
C04	5	5	4	5	3	5	5	3	3	5
C05	5	5	4	5	4	5	5	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK525-2023	Measurement and Instrumentation in Electrical Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK525-2023	Measurement and Instrumentation in Electrical Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
Increasing measurement knowledge in electrical systems.
Teaching Methods and Techniques:
Definitions such as measurement, error, accuracy, precision. Static and dynamic measurement systems Characteristics. Error types, error analysis. Working of analog and digital measuring instruments principles, accuracy, calibrations. AC or DC current and voltage measurement methods and standards. Sampling and quantization of analog signals. Digital analog and analogue digital converter structures. Power and energy measurement. Types of sensors, working principles and characteristics. Analog and digital data acquisition systems.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Ali YÜCE
Assistants:

Recommended or Required Reading

Resources

Kalsi, H. S. (2004). Electronic instrumentation (2nd ed.). McGraw-Hill.,Helfrick, A. D., & Cooper, W. D. (2002). Modern elektronik enstrümantasyon ve ölçme teknikleri (5. Bell, D. A. (2003). Electronic instrumentation and measurements (2nd ed.). PHI.
Kalsi, Electronic Instrumentation, Second edition, Mc Graw-Hill, 2004. A. D. Hell Frick and W.D Cooper, Modern Electronic Instrumentation & Measurement Techniques, PH1, 5th, 2002.

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Entrance. Definitions: Measurement, error, accuracy, precision, etc.		
2	Static and dynamic characteristics of measurement systems.		
3	Error types, error analysis.		
4	Analog measuring instrument: Working principles, accuracy.		
5	Structure of digital measuring instruments, calibration principles, common mode suppression ratios.		
6	AC or DC current and voltage measurement methods and standards.		
7	Bridge measurement methods (Wheatsone, Kelvin, Maxwell, Hay bridge).		
8	MIDTERM		
9	Operational amplifier and measurement amplifiers, Average and effective value converters,Phase sensitive rectifier.		
10	Sampling and quantization of analog signals. DAC and ADC structures.		
11	Measuring power and energy.		
12	Sensors: Working principles, characteristics.		
13	Sensors: Working principles, characteristics.		
14	Analog and digital data acquisition systems.		
15	Analog and digital data acquisition systems.		
16	SEMESTER FINAL EXAM		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Learns to use measurement techniques in electrical systems.
C02	Learns the working principles of analog and digital measuring devices.
C03	Learns the working principles of sensors.
C04	Gains the ability to design circuits with sensors.
C05	Learns various measurement circuits implemented with operational amplifiers.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	12	168
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	6	6
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	10	10
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	4	4	3	5	4	3	3	4
C01	5	4	4	4	3	5	4	3	3	4
C02	4	4	3	4	3	5	3	3	2	4
C03	4	4	3	4	3	5	3	3	2	4
C04	4	4	5	4	3	5	4	3	3	4
C05	4	4	4	4	3	5	4	3	3	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK528-2023	Electric Vehicles				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK528-2023	Electric Vehicles	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
This course aims to provide students with fundamental knowledge of electric vehicle technologies and help them understand their operating principles.
Teaching Methods and Techniques:
Conventional hybrid, plug-in hybrid and fully electric vehicles, wired and wireless charging methods, electric vehicle charging standards, battery systems, propulsion in electric vehicles systems and mobility of electric vehicles.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Emrullah AYDIN
Assistants:

Recommended or Required Reading

Resources

Husain, I. (2011). Electric and hybrid vehicles: Design fundamentals (2nd ed.). CRC Press.
Denton, T., & Pells, H. (2024). Electric and hybrid vehicles. Routledge.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to electric vehicles		
2	Conventional hybrid vehicles		
3	Rechargeable hybrid vehicles		
4	Fully electric vehicles		
5	Fully electric vehicles		
6	Identification of charging and range problems of electric vehicles		
7	Wired charging methods, CCS standards		
8	MIDTERM		
9	Wireless charging methods		
10	Electric vehicle charging standards		
11	Battery systems		
12	Drive systems in electric vehicles		
13	Electric motors used in electric vehicles		
14	Mobility of electric vehicles		
15	SEMESTER FINAL EXAM		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Learns the development of electric vehicles from their emergence to the present day.
C02	Learns about the components of an electric vehicle.
C03	Gains insight into the integration of electric vehicles with future technologies.
C04	Analyzes the energy management and battery systems of electric vehicles.
C05	Evaluates the performance of electric vehicles under different driving conditions.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	15	3	45
Hours for off-the-c.r.stud	5	4	20
Assignments	5	2	10
Presentation	0	0	0
Mid-terms	1	30	30
Practice	3	4	12
Laboratory	0	0	0
Project	2	4	8
Final examination	2	50	100
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	3	2	3	3	3	2	3	2	4
C01	4	3	2	3	3	3	2	3	2	4
C02	5	4	3	4	3	5	3	3	3	4
C03	4	4	4	4	3	4	4	3	3	5
C04	5	5	4	5	3	5	5	3	3	5
C05	5	5	4	5	4	5	5	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK521-2023	Modeling and Control of Electromechanical Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK521-2023	Modeling and Control of Electromechanical Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
To teach the design of new systems consisting of a combination of mechanical, electrical, electronic and computer systems. To teach the approach of mechatronic system design with methods such as hardware-loop simulation.
Teaching Methods and Techniques:
System integration; Sensor Modelling: Basic concepts and modelling of various types of sensors; Actuator Modelling : Electrical, hydraulic and pneumatic actuators; Modelling of signal and power transmission elements; Mixed System Modelling: Events and States, State flow modelling; Mechatronic System Modelling: Block diagrams and State space representation, Object based modelling, Imaginary prototyping, Hardware loop simulation; Real time monitoring and control.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Emrullah AYDIN
Assistants:

Recommended or Required Reading

Resources	Giurgiutiu, V., & Lyshevski, S. E. (2003). Micromechatronics: Modeling, analysis, and design with MATLAB. CRC Press. De Silva, C. W. (2010). Mechatronics: A foundation course. Taylor & Francis/CRC Press. Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 40	**Science**	: 20
Engineering Design	: 40	**Health**	:
Social Sciences	:	**Field**	:

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	System integration		
2	Sensor Modelling		
3	Basic concepts and modelling of various types of sensors		
4	Actuator Modelling		
5	Electrical, Hydraulic and Pneumatic Actuators		
6	Modelling of signal and power transmission elements		
7	Mixed System Modelling		
8	Midterm Exam		
9	Events and Situations		
10	Modelling with state flow		
11	Mechatronic System modelling		
12	Block diagrams and state space representation		
13	Object-based modelling, Imaginary prototyping, Hardware cycle simulation		
14	Real-time monitoring and control		
15	Error analysis and performance improvement methods in mechatronic systems		
16	Final Exam		

Course Learning Outcomes

No	Learning Outcomes
C01	Designs mechatronic systems using mathematical modeling methods.
C02	Performs simulations to observe the behavior of the modeled mechatronic system.
C03	Gains competence in the tools and software used for mechatronic system modeling and design.
C04	Compares different modeling approaches (block diagrams, signal flow diagrams, bond-graph methods) and applies model reduction techniques.
C05	Validates the mechatronic system model using real system data and evaluates its performance.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	9	126
Assignments	5	4	20
Presentation	0	0	0
Mid-terms	1	9	9
Practice	3	4	12
Laboratory	0	0	0
Project	2	4	8
Final examination	1	9	9
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	5	4	4	3	5	4	3	3	4
C01	4	5	4	3	1	5	4	3	3	4
C02	4	4	4	4	3	5	4	3	3	4
C03	4	4	4	4	3	5	4	3	4	4
C04	3	5	4	5	3	5	5	3	3	4
C05	4	5	4	4	3	5	5	3	3	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK534-2023	Modeling of Electronic Elements				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK534-2023	Modeling of Electronic Elements	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
Learning the concept of modeling. computer simulation basic electronic elements and integrated circuits for nonlinear models of structures and macro Having information about models. Element model and Giving the ability to develop macromodels. Model parameter Ability to develop measurement methods.
Teaching Methods and Techniques:
Modeling concept. Element models: Diode models. bipolar transistor models: EM (Ebers- Moll) 1 model, EM2 model, EM3 model, Gummel- Poon model, SPICE Gummel-Poon model, improved EM model. JFET models: SPICE JFET model, High accuracy JFET model. MOSFET models: SPICE 1. level, level 2, level 3, level 4 MOS models. High accuracy MOSFET model. Macromodels: Transactional amplifier, Voltage comparator, Operational transconductance amplifier (OTA), current carrier, analog multiplication circuit macromodels. Modeling of power electronic elements. Measurement of model parameters.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Mehmet Üstündağ
Assistants:

Recommended or Required Reading

Resources

Antognetti, P. ve Massobrio, G. (1988). Semiconductor device modeling with SPICE. Mc Graw Hill. Foty, D. P. (1997). MOSFET modeling with SPICE Principles and Practice
Antognetti, P. ve Massobrio, G. (1988). Semiconductor device modeling with SPICE. Mc Graw Hill.
Foty, D. P. (1997). MOSFET modeling with SPICE Principles and Practice. Prentice Hall.
Gray, P. R., Hurst, P. J., Lewis, S. H., Meyer, R. G. (2001). Analysis and design of analog integrated circuits.4th Edition, John Wiley & Sons, Inc.
Kuntman, H. (1998). Elektronik Elemanların Modellenmesi. İTÜ Kütüphanesi, Sayı 1600.
Liu, W. (2001). MOSFET models for SPICE simulation including BSIM3v3 and BSIM4. John Wiley & Sons

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	30	**Science**	:	
Engineering Design	:	50	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Modeling concept. Element models: Diode models.	Reading source material and review	Recommended resources
2	Bipolar transistor models: EM (Ebers-Moll) 1 model, EM2 model,EM3 model.	Reading source material and review	Recommended resources
3	Gummel-Poon model.	Reading source material and review	Recommended resources
4	SPICE Gummel-Poon model, improved EM model.	Reading source material and review	Recommended resources
5	JFET models: SPICE JFET model, high accuracy JFET	Reading source material and review	Recommended resources
6	MOSFET models: SPICE Level 1 and Level 2 MOS models	Reading source material and review	Recommended resources
7	SPICE level 3 MOS models.	Reading source material and review	Recommended resources
8	Midterm.		
9	BSIM models.	Reading source material and review	Recommended resources
10	High accuracy MOSFET models.	Reading source material and review	Recommended resources
11	Operational amplifier, Operational transconductance amplifier	Reading source material and review	Recommended resources
12	Current carrier, analog multiplication circuit macromodels.	Reading source material and review	Recommended resources
13	Macromodels of power electronic elements.	Reading source material and review	Recommended resources
14	Measurement of Element Model parameters.	Reading source material and review	Recommended resources
15	Measurement of Element Model parameters	Reading source material and review	Recommended resources
16	FINAL EXAM		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Develops mathematical models based on the physical behavior of semiconductor devices.
C02	Predicts the performance parameters of electronic circuits by applying small-signal and large-signal modeling techniques.
C03	Compares and validates different modelling approaches using numerical simulation tools (SPICE etc.).
C04	It performs realistic circuit analysis by modeling the temperature, noise and parasitic effects of electronic elements.
C05	Selects appropriate modeling methods for new generation semiconductor technologies (GaN, SiC, etc.) and critically evaluates developments in the literature.
C06	It evaluates the accuracy of the model by comparing it with reference data.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	11	154
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	12	12
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	17	17
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	1	3	3	4	1	3	2	1	1	1
C01	1	3	3	5	1	2	2	1	1	2
C02	1	3	3	3	1	2	2	1	1	1
C03	1	3	2	3	1	3	1	1	1	1
C04	1	3	5	4	1	2	3	1	1	1
C05	1	3	4	4	1	3	2	1	1	1
C06	1	3	3	4	1	3	3	1	1	1

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK522-2023	Industrial Auto Control Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK522-2023	Industrial Auto Control Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to learn the design and analysis of sensors, amplifiers, data converters, electronic and microprocessor-based measurement and control systems used in industrial automatic control systems, their devices and programs, and industrial applications.
Teaching Methods and Techniques:
Introduction to industrial automatic control systems, historical development. Sensors, Transducers and applications. Operational amplifiers and applications. Analog / Digital (ADC), Digital / Analog (DAC), Frequency / Voltage, Voltage / Frequency, Converters and applications. Control applications using discrete circuit components. Microprocessor based control applications. Design and implementation of a small microcontroller-based temperature and motor control system. LabVIEW control software and applications.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Ali YÜCE
Assistants:

Recommended or Required Reading

Resources

Wells, L. K., & Travis, J. (1997). LabVIEW for everyone: Graphical programming made even easier. Prentice-Hall.
Uzun, T. (t.y.). Ders notları. Retrieved from http://www.tuncayuzun.com/

Dorf, R. C., & Bishop, R. H. (2020). Modern control systems. Nobel Akademik Yayıncılık.

Kuo, B. C. (1999). Automatic control systems. Literatür Yayınları.

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 30	**Science**	:
Engineering Design	: 40	**Health**	:
Social Sciences	:	**Field**	: 30

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to industrial automatic control systems, History of industrial automatic control systems.		
2	Sensors, Transducers and Applications.		
3	Sensors, Transducers and Applications.		
4	Operational amplifiers and applications.		
5	Operational amplifiers and applications.		
6	Analog Digital (ADC), Digital Analog (DAC), Frequency Voltage (F/V), Voltage Frequency (V/F) converters and Applications		
7	Control applications using discrete circuit elements.		
8	Midterm Exam		
9	Control applications using microprocessor based system		
10	LabVIEW control software and applications.		
11	LabVIEW control software and applications.		
12	Design and implementation of a small microcontroller-based temperature and motor control system.		
13	Design and implementation of a small microcontroller-based temperature and motor control system.		
14	Design and implementation of a small microcontroller-based temperature and motor control system.		
15	Design and implementation of a small microcontroller-based temperature and motor control system.		
16	Final Exam		

Recommended Optional Programme Components

ELK526-2023 Mathematical Methods in Control Engineering

Course Learning Outcomes

No	Learning Outcomes
C01	Gains knowledge on the history of industrial automatic control systems.
C02	Learns sensors and their applications in industrial automatic control systems.
C03	Learns operational amplifiers and their applications.
C04	Learns Analog Digital (ADC), Digital Analog (DAC), Frequency Voltage (F/V), Voltage Frequency (V/F) converters.
C05	Gains knowledge on control applications using discrete circuit elements.
C06	Gains knowledge on microprocessor based control applications.
C07	Gains knowledge on the design and implementation of the temperature and engine control system project.
C08	Gains knowledge on LABVIEW control software and applications.
C09	Learns the design, analysis and simulation of industrial automatic control systems software used in PC-based systems.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	12	168
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	6	6
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	10	10
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	3	3	2	3	3	3	2	3	2	4
C01	3	3	2	3	3	3	2	3	2	4
C02	4	4	3	4	3	5	3	3	3	4
C03	4	4	3	4	3	5	3	3	3	4
C04	4	4	3	4	3	5	3	3	3	4
C05	4	4	4	4	3	5	4	3	3	4
C06	4	5	4	4	3	5	4	3	3	5
C07	4	5	5	4	4	5	4	3	4	5
C08	4	4	4	4	4	5	4	3	3	5
C09	4	5	5	4	4	5	5	3	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK506-2023	Energy Transmission Systems Analysis				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK506-2023	Energy Transmission Systems Analysis	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
To provide knowledge and skills to analyze and design power systems consisting of electricity generation and transmission systems under normal operation and faulty conditions such as short circuits.
Teaching Methods and Techniques:
Basic concepts in power systems analysis, Models and performance analysis of transmission lines, Load flow analysis, Short circuit fault analysis, Stability of power systems
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Şahin SÖNMEZ
Assistants:

Recommended or Required Reading

Resources

1. H. Saadat, Power System Analysis, McGraw-Hill, 1999. 2. Hüseyin Çakır, Elektrik Güç Sistemlerinin Analizi.

1. H. Saadat, Power System Analysis, McGraw-Hill, 1999.
2. Hüseyin Çakır, Elektrik Güç Sistemlerinin Analizi.

Course Category

Mathmatics and Basic Sciences	:	30	**Education**	:	
Engineering	:	50	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to power systems analysis: Continuous sinusoidal state, phasor diagrams, active, reactive and power concepts		
2	Elements of the power system; generators, transformers and loads		
3	Single line and impedance diagrams of power systems and application of the unit values (pu) method		
4	Energy transmission lines; modeling of short, medium and long distance lines		
5	Performance analysis of energy transmission lines		
6	Bus admittance and impedance matrix models		
7	Load flow analysis and methods used		
8	Midterm exam		
9	Carrying out load flow analysis with Gauss and Gauss-Seidel methods		
10	Carrying out load flow analysis with Gauss and Gauss-Seidel methods		
11	Load flow analysis with Newton-Raphson method		
12	Load flow analysis with Newton-Raphson method		
13	Symmetrical components		
14	Application of symmetrical components in voltage and current imbalances		
15	String components and string component circuits of generators, transformers, transmission lines and loads		
16	Final exam		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	They create impedance admittance models of electrical power systems
C02	They analyze and design electrical power systems using the unit value method.
C03	They use load flow analysis methods effectively in system analysis and design
C04	Have basic knowledge about the stability of power systems
C05	They calculate the parameters of transmission lines in the field of power systems.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	5	70
Assignments	14	5	70
Presentation	0	0	0
Mid-terms	1	2	2
Practice	0	0	0
Laboratory	0	0	0
Project	2	20	40
Final examination	1	2	2
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
C01	1	4	2	3	2	3	4	2	2	3
C02	1	2	2	3	5	3	4	3	1	1
C03	2	3	2	2	4	3	4	3	3	2
C04	3	3	3	4	2	2	1	3	2	1
C05	3	2	1	5	3	2	4	2	3	3

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK508-2023	Energy Quality				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK508-2023	Energy Quality	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The objective of this course is to introduce students to energy quality problems encountered in electric power systems and to teach them their causes, effects, and solutions. Students will learn to analyze energy quality problems such as harmonics, voltage sags, interruptions, and transients, and to develop solutions using measurement, evaluation, and filtering techniques.
Teaching Methods and Techniques:
This course begins with an introduction to the fundamental concepts and problems related to energy quality. Students learn the importance of energy quality for sustainability and the standard definitions used in its assessment. Then, the analysis of non-sinusoidal waves is examined, addressing power quality problems such as voltage sags, interruptions, and transient voltage spikes. The course continues with an emphasis on harmonic distortion and its metrics. Harmonic-generating elements are introduced, and the effects of harmonics on electrical devices are evaluated. Methods for correcting power factor under non-sinusoidal conditions, as well as monitoring and evaluating energy quality, are also covered. Finally, the fundamental principles of harmonic control and the devices used to control harmonic distortion are discussed. The course concludes with the design of active and passive harmonic filters and solution approaches for improving energy quality.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Kadir Doğanşahin
Assistants:

Recommended or Required Reading

Resources

Bollen, M. H. J., & Hassan, F. (2011). Integration of distributed generation in the power system. Wiley-IEEE Press.
Dugan, R. G., McGranaghan, M. F., Santoso, S., & Beaty, H. W. (2002). Electrical power system quality. McGraw-Hill.
- Kocatepe, C. (2003). Elektrik tesislerinde harmonikler. Birsen Yayınevi.

Course Category

Mathmatics and Basic Sciences	:	30	**Education**	:	
Engineering	:	50	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to energy quality problems, concepts and definitions used in energy sustainability and evaluation of energy qu		
2	Analysis of non-sinusoidal waves		
3	Voltage sags and interruptions		
4	Temporary voltage spikes		
5	Definition of system quantities in non-sinusoidal conditions		
6	Harmonic distortion and harmonic criteria		
7	Harmonic producing elements		
8	Midterm Exam		
9	Components generate harmonics		
10	Effects of harmonics on electrical devices		
11	Correction of power factor in non-sinusoidal conditions		
12	Monitoring and evaluating energy quality		
13	Principles of harmonic control		
14	Devices used to control harmonic distortion		
15	Harmonic filter design		
16	Final exam		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Defines energy quality, classifies energy quality problems by explaining concepts and standards.
C02	Analyzes non-sinusoidal waves and their harmonic distortions and applies relevant criteria.
C03	Analyze power quality problems such as voltage drops, interruptions, and temporary voltage spikes.
C04	Analyzes harmonic sources and their effects on electrical devices and applies power factor correction methods.
C05	Designs active and passive harmonic filters and develops solutions to improve energy quality.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%25
Quizzes	0	%0
Assignment	4	%15
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%60
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	4	56
Assignments	4	12	48
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	48	48
Total Work Load			**224**
ECTS Credit of the Course			**7**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	4	4	3	5	4	3	3	4
C01	4	4	3	4	3	4	3	3	3	4
C02	4	5	4	4	3	5	4	3	3	4
C03	4	4	4	4	3	4	4	3	3	4
C04	4	4	5	4	4	5	5	3	4	4
C05	4	5	5	4	4	5	5	4	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK502-2023	Filter Design Methods				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK502-2023	Filter Design Methods	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The filter design course aims to explain to students the basic principles of analog and digital filters. This course provides information on frequency response, crossover region, cutoff frequency and other important parameters. Additionally, it focuses on design methods and practices.
Teaching Methods and Techniques:
Basic Concepts: Filter types (low pass, high pass, band pass, band stop), filter characteristics expressed in the frequency domain. Analog Filter Design: Passive RC and LC filters, active filters (Butterworth, Chebyshev, Elliptical), design methods and frequency responses. Digital Filter Design: Ideal and real digital filters, FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) filters, digital filter design algorithms (windowing, Parks-McClellan, etc.). Applications: Filter use in audio processing, image processing, communication systems and biomedical applications.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Prof. Dr. Melih Cevdet İNCE
Assistants:

Recommended or Required Reading

Resources

Tran, T.T. (2023). Analog Filter Design. In: High-Speed System and Analog Input/Output Design . Springer, Cham. https://doi.org/10.1007/978-3-031-04954-5_4
Iyer, S.V. (2020). Filter Design. In: Digital Filter Design using Python for Power Engineering Applications. Springer, Cham. https://doi.org/10.1007/978-3-030-61860-5_7

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	50	**Science**	:	
Engineering Design	:	30	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Input and Filter Design OverviewBasic principles of filtersFilter types and areas of use		
2	Analog Filter DesignPassive RC and LC filtersActive filters (Butterworth, Chebyshev, Elliptical)Design methods and frequenc		
3	Digital Filter DesignIdeal and real digital filtersFIR (Finite Impulse Response) and IIR (Infinite Impulse Response) filtersDig		
4	Frequency Response AnalysisFilter characteristics (low pass, high pass, band pass, band stop)Filter responses expressed in		
5	Transition Zone and Cutoff FrequencyDetermining transition zone width and cutoff frequencyEffect of design parameters		
6	Filter OptimizationDesign goals (e.g. smooth transition region, minimum phase loss)Methods for design optimization		
7	Filter ApplicationsFilter use in audio processing, image processing, communication systems and biomedical applications		
8	Midterm Exam		
9	In-Depth Filter DesignAdvanced design methods (e.g. Chebyshev type II, Cauer)Filter design software and tools		
10	In-Depth Filter DesignAdvanced design methods (e.g. Chebyshev type II, Cauer)Filter design software and tools		
11	In-Depth Filter DesignAdvanced design methods (e.g. Chebyshev type II, Cauer)Filter design software and tools		
12	Cauer (Elliptical) Filters: This week, Cauer filters provide sharper transition region and lower passband rips.		
13	Different Filter Architectures: For example, multi-feedback filters or stacked filters		
14	Design Applications with MATLAB or Python		
15	Design Applications with MATLAB or Python		
16	Final Exam		

Recommended Optional Programme Components

ELK510-2023 Nonlinear Control Systems

Course Learning Outcomes

No	Learning Outcomes
C01	Understands the basic theoretical principles and mathematical models of analog and digital filters.
C02	Designs and applies filters for real-world problems using different filter design techniques.
C03	Analyzes filter performance.
C04	Acquires the research and problem-solving skills necessary to develop new filter design methods.
C05	Evaluates the applicability of the designed filters in real-time systems.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	15	3	45
Hours for off-the-c.r.stud	5	4	20
Assignments	5	2	10
Presentation	0	0	0
Mid-terms	1	30	30
Practice	3	4	12
Laboratory	0	0	0
Project	2	4	8
Final examination	2	50	100
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	3	4	3	4	3	3	2	4
C01	5	4	3	4	3	4	3	3	2	4
C02	5	5	4	4	3	5	4	3	3	5
C03	5	5	4	5	3	5	5	3	3	5
C04	4	5	5	4	3	4	5	3	3	5
C05	5	5	4	5	3	5	4	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK513-2023	Artificial Intelligence Applications in Embedded Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK513-2023	Artificial Intelligence Applications in Embedded Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
These categories rules, GPU AI recording on general integrated cards training and improving the ability to integrate these technologies into embedded systems.
Teaching Methods and Techniques:
This course will teach students artificial intelligence applications on GPU-based integrated cards. aims. In the course, students will learn about the structure and features of GPU-based integrated cards. While learning, you will also become familiar with basic artificial intelligence concepts such as deep learning and artificial neural networks. they will be. Additionally, optimization techniques and object optimization techniques for real-time applications Specialized topics such as perception will also be addressed. Through projects, students They will have the opportunity to turn the knowledge they have acquired into practice and use GPU- based integrated cards. They will gain skills in developing artificial intelligence applications.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Gürkan Kavuran
Assistants:

Recommended or Required Reading

Resources

1. TinyML: Machine Learning with Tensorflow Lite on Arduino and Ultra-Low Power Microcontrollers", Pete Warden and Daniel Situnayake, ISBN 9781492052043

1. TinyML: Machine Learning with Tensorflow Lite on Arduino and Ultra-Low Power
Microcontrollers", Pete Warden and Daniel Situnayake, ISBN 9781492052043

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to GPU Based Integrated Cards: GPU based integrated cards and their features, CUDA and OpenCLParallel prc		
2	Introduction to GPU Based Integrated Cards: GPU based integrated cards and their features, CUDA and OpenCLParallel prc		
3	Deep Learning and Artificial Neural Networks: Deep learning fundamentals, Artificial neural networks and their types, Integ		
4	Deep Learning and Artificial Neural Networks: Deep learning fundamentals, Artificial neural networks and their types, Integ		
5	Artificial Intelligence Applications and Optimization: Optimization techniques for real-time applications,Model optimization a		
6	Artificial Intelligence Applications and Optimization: Optimization techniques for real-time applications,Model optimization a		
7	Design of deep learning network structures in MATLAB environment and compilation for NVDIA Jetson modules		
8	Midterm Exam		
9	Design of deep learning network structures in MATLAB environment and compilation for NVDIA Jetson modules		
10	Design of deep learning network structures in MATLAB environment and compilation for NVDIA Jetson modules		
11	Object Detection and Classification: Object detection and classification algorithms, YOLO (You OnlyFast object detection m		
12	Object Detection and Classification: Object detection and classification algorithms, YOLO (You OnlyFast object detection m		
13	Image Processing and Deep Learning: Image processing fundamentals, For image segmentation and recognitiondeep learn		
14	Image Processing and Deep Learning: Image processing fundamentals, For image segmentation and recognitiondeep learn		
15	Project Development and Application: Artificial intelligence for students' real-world problemsapplication development proce		
16	Final Exam		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Understanding the structure and functions of GPU-based integrated cards.
C02	How artificial intelligence techniques are implemented in GPU-based integrated cards clutch.
C03	Being able to create deep learning and artificial neural network models on integrated cards.
C04	To learn optimization techniques for real-time applications.
C05	Artificial intelligence in GPU-based embedded cards to solve real-world problems To develop the ability to use.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%15
Quizzes	0	%0
Assignment	1	%15
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	10	140
Assignments	1	7	7
Presentation	1	7	7
Mid-terms	1	15	15
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	15	15
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04
C01			5	
C03		4		
C04				4
C05	4			

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK505-2023	Dynamics and Control of Power Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK505-2023	Dynamics and Control of Power Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
To provide students with the knowledge, methods and tools that will enable them to perform dynamic and control analyzes of electrical power systems, including issues such as small signal, transient stability, active and reactive power control, economical power production and security of power systems.
Teaching Methods and Techniques:
Basic concepts in power systems analysis, elements of power systems, small signal, transient and voltage stability, active power and load-frequency control, reactive power and voltage control, economical power production and security of power systems and optimum load flow analysis.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Şahin Sönmez
Assistants:

Recommended or Required Reading

Resources

3. P. Kundur, Power System Stability and Control Analysis, McGraw-Hill, 1994. 4. A. J. Wood and B. F. Wollenberg, Power Generation, Operation and Contr
1. H. Saadat, Power System Analysis, McGraw-Hill, 1999.
2. P. W. Sauer and M. A. Pai, Power System Dynamics and Stability, Prentice Hall, 1998

Course Category

Mathmatics and Basic Sciences	:	30	**Education**	:	
Engineering	:	50	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to a brief summary of the operation of power systems:		
2	Introduction to dynamics and control of power systems		
3	Models of the elements of the power system; generators, transformers and loads		
4	Stability analysis of power systems: Small signal stability		
5	Transient stability and equal areas criterion		
6	Transient stability analysis of systems containing many generators		
7	Voltage stability		
8	Midterm exam		
9	Economical load distribution		
10	Active power control		
11	Load frequency and automatic production control		
12	Excitation systems		
13	Reactive power control		
14	Security of power systems		
15	Current load frequency control methods		
16	Final exam		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Students gain knowledge about the basic problems in the dynamics and control of electrical power systems.
C02	Students learn small signal, transient stability analysis of electrical power systems using Matlab program.
C03	Students solve problems encountered in active and reactive power control
C04	Students perform security analyzes on power systems.
C05	Students perform dynamic analysis.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	6	84
Hours for off-the-c.r.stud	14	5	70
Assignments	9	5	45
Presentation	0	0	0
Mid-terms	1	2	2
Practice	0	0	0
Laboratory	0	0	0
Project	1	22	22
Final examination	1	2	2
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
C01	1	4	3	2	1	2	1	1	2	2
C02	1	2	5	2	3	4	3	1	2	3
C03	4	1	2	3	3	4	2	1	2	1
C04	2	1	3	2	4	2	3	3	1	2
C05	2	1	4	3	2	4	2	2	1	1

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK536-2023	Advanced Analog All Circuits				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK536-2023	Advanced Analog All Circuits	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to develop the competence to analyze CMOS analog integrated circuit building blocks and to design analog blocks that meet specified performance criteria.
Teaching Methods and Techniques:
Basic relations. Basic MOS (Metal Oxide Semiconductor) building blocks: Diode connected MOS transistor, current sources, reference voltage generators. Strengthening multiples. CMOS (Complementary Metal Oxide Semiconductor) operational amplifiers. CMOS OTA (Operational Transconductance Amplifier) design. CMOS current carrier. CMOS analog multiplication circuit design. CMOS oscillator circuits: SC (Switched Capacitor) oscillators, CMOS charge-discharge oscillators, CMOS OTA-C oscillators, Current carrier RC oscillators. Analog signal processing: SC filters, CMOS OTA-C active filters, active filter structures realized with current carrier.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Mehmet ÜSTÜNDAĞ
Assistants:

Recommended or Required Reading

Resources

Analog Integrated Circuit Design, KUNTMAN, Birsen Publishing House, 2nd Edition, Istanbul, 1998
Analog Integrated Circuit Design, KUNTMAN, Birsen Publishing House, 2nd Edition, Istanbul, 1998
Design of Analog Integrated Circuits and Systems, K. R. LAKER, W and M. C. SANSEN, Mc Graw-Hill, 1994
Analog Integrated Circuit Design, D. JOHNS, K. MARTIN, John Wiley & Sons, New York, 1997
Design of Analog CMOS Integrated Circuits, B. RAZAVI, Mc Graw-Hill, 2000

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 60	**Science**	:
Engineering Design	: 40	**Health**	:
Social Sciences	:	**Field**	:

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction and basic relations.	Reading source material and review	Recommended resources
2	Basic MOS (Metal Oxide Semiconductor) building blocks.	Reading source material and review	Recommended resources
3	Diode connected MOS transistor, current sources, reference voltage generators.	Reading source material and review	Recommended resources
4	Diode connected MOS transistor, current sources, reference voltage generators	Reading source material and review	Recommended resources
5	Strengthening multiples.	Reading source material and review	Recommended resources
6	CMOS (Complementary Metal Oxide Semiconductor) operational amplifiers.	Reading source material and review	Recommended resources
7	CMOS OTA (Operational Transconductance Amplifier) design	Reading source material and review	Recommended resources
8	MIDTERM		
9	CMOS current carrier.	Reading source material and review	Recommended resources
10	CMOS analog multiplication circuit design.	Reading source material and review	Recommended resources
11	CMOS oscillator circuits: SC (Switched Capacitor) oscillators, CMOS charging-discharging oscillators.	Reading source material and review	Recommended resources
12	CMOS oscillator circuits: SC (Switched Capacitor) oscillators, CMOS charging-discharging oscillators.	Reading source material and review	Recommended resources
13	Analog signal processing: SC filters, CMOS OTA-C active filters.	Reading source material and review	Recommended resources
14	Analog signal processing: SC filters, CMOS OTA-C active filters.	Reading source material and review	Recommended resources
15	Analog signal processing: SC filters, CMOS OTA-C active filters.	Reading source material and review	Recommended resources
16	FINAL EXAM		

Recommended Optional Programme Components

ELK535-2023 Next Digital Circuits

Course Learning Outcomes

No	Learning Outcomes
C01	Constructs and analyzes small-signal and large-signal models of analog integrated circuits.
C02	Designs high-performance analog building blocks (current mirrors, amplifiers, oscillators, etc.).
C03	Evaluates noise, nonlinearity, and frequency response parameters in analog integrated circuits.
C04	Performs design, simulation, and verification of advanced CMOS-based analog circuits.
C05	Critically examines current research trends and innovative approaches in analog integrated circuit technologies
C06	Evaluates the frequency behavior of analog oscillator and active filter circuits.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	11	154
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	14	14
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	15	15
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	1	3	3	4	1	2	2	1	1	1
C01	1	3	3	3	1	2	2	1	1	1
C02	5	3	3	4	1	2	2	1	1	1
C03	1	3	5	4	1	3	2	1	1	1
C04	1	3	5	4	1	3	2	1	1	1
C05	1	3	2	5	1	2	1	1	1	1
C06	1	3	3	5	1	2	2	1	1	1

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK524-2023	Advanced Optimization Techniques				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK524-2023	Advanced Optimization Techniques	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
This course aims to enable students to understand and apply various optimization methods. Students will gain the ability to implement these methods in MATLAB and use them effectively to solve real-world problems.
Teaching Methods and Techniques:
Unconstrained Optimization, Single-variable Optimization, Analytical Methods, Multivariable Optimization (unconstrained), Constrained Optimization (equality constraints), Heuristic and Metaheuristic Methods, Evolutionary Algorithms, Multi-objective Optimization, Application and evaluation of optimization techniques on classical test functions, Applications of optimization techniques to real-world problems.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Yağmur ÖLMEZ
Assistants:

Recommended or Required Reading

Resources

R.L.Fox: 'Optimization Methods for Engineering Design'. Addison Wesley, 1971.
Derviş Karaboğa, Artificial Intelligence Optimization Algorithms, 2006.
R.L.Fox: 'Optimization Methods for Engineering Design'. Addison Wesley, 1971.
A. Ravindran, K. M. Ragsdell and G. V. Reklaitis: 'Engineering Optimization: Methods and Applications'. John Wiley & Sons, Inc, 2006.

Course Category

Mathmatics and Basic Sciences	:	0	**Education**	:	0
Engineering	:	40	**Science**	:	0
Engineering Design	:	50	**Health**	:	0
Social Sciences	:	0	**Field**	:	10

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Course introduction and scope, The role of optimization in engineering and science, Fundamental concepts: optimum, deci		
2	Unconstrained Optimization, Single-variable optimization, Analytical methods: derivative-based solution, finding maxima–m		
3	Multivariable optimization (unconstrained), Gradient, Hessian, second-order conditions, Newton and derivative-based meth		
4	Constrained optimization (equality constraints)		
5	Heuristic and Metaheuristic Methods		
6	Evolutionary Algorithms,		
7	Multi-objective Optimization		
8	Midterm exam		
9	Application and evaluation of optimization techniques on classical test functions		
10	Applications of optimization techniques in control systems		
11	Applications of optimization techniques in machine learning methods		
12	Applications of optimization techniques in the field of image processing		
13	Applications of optimization techniques in feature engineering		
14	Applications of optimization techniques on engineering system designs		
15	General reviewStudent project/assignment presentationsApplied case studies and current research topics		
16	Final exam		

Recommended Optional Programme Components

ELK523-2023 System Dynamics Modeling and Simulation

Course Learning Outcomes

No	Learning Outcomes
C01	Recognizes the basic concepts of optimization.
C02	Solves constrained and unconstrained optimization methods.
C03	It solves real-world problems with optimization methods.
C04	Implements heuristic and metaheuristic methods.
C05	Applies optimization techniques to classical test functions.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	7	98
Assignments	2	3	6
Presentation	0	0	0
Mid-terms	1	35	35
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	40	40
Total Work Load			**221**
ECTS Credit of the Course			**7**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	4	4	3	4	4	1	2	1
C01	2	5	4	4	2	5	3	1	1	1
C02	5	3	5	4	2	5	4	1	1	1
C03	5	4	5	3	4	3	5	1	4	1
C04	5	5	3	3	3	5	4	1	1	1
C05	2	3	3	4	3	4	4	1	1	1

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK535-2023	Next Digital Circuits				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK535-2023	Next Digital Circuits	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
Implementation of digital circuits on FPGAs using VHDL language.
Teaching Methods and Techniques:
Equivalence relation, partial order relation, lattice structures, Boolean algebra. State reduction on fully determinate sequential machines. State coding in synchronous sequential circuits. Separation of sequential machines. Circuit design with field programmable gate arrays. Analysis of digital circuits with VHDL (Very High Speed Integrated Circuits Hardware Description Language). Design of asynchronous sequential circuits, critical race-free coding methods. Circuit design with programmable logic elements. Error analysis in digital circuits.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Mehmet ÜSTÜNDAĞ
Assistants:

Recommended or Required Reading

Resources

Fundamentals of Digital Logic with VHDL Design, S. BROWN, Z. VRANESIC, McGraw-Hill, 2000
Synhesis and Optimization of Digital Circuits, G.De MICHELI, McGraw-Hill, 1995.
Logic Synthesis for Field Programmable Gate Arrays, R. MURGAI, R.K. BRAYTON and Sangiovanni VINCENTELLI, Kluwer Academic Publishers, 1995
Fundamentals of Digital Logic with VHDL Design, S. BROWN, Z. VRANESIC, McGraw-Hill, 2000
Circuit Design with VHDL, V.A. PEDRONI, MIT Pres, 2007
Digital Design with CPLD Applications and VHDL, R.K. DUECK, Thomson Delmar Learning, 2000.

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	40	**Science**	:	
Engineering Design	:	40	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Equivalence relation	Reading source material and review	Recommended resources
2	Partial order relation	Reading source material and review	Recommended resources
3	lattice structures	Reading source material and review	Recommended resources
4	boolean algebra	Reading source material and review	Recommended resources
5	State reduction on fully determinate sequential machines.	Reading source material and review	Recommended resources
6	State coding in synchronous sequential circuits.	Reading source material and review	Recommended resources
7	Circuit design with field programmable gate arrays.	Reading source material and review	Recommended resources
8	MIDTERM		
9	Circuit design with field programmable gate arrays.	Reading source material and review	Recommended resources
10	Analysis of digital circuits with VHDL (Very High Speed Integrated Circuits Hardware Description Language).	Reading source material and review	Recommended resources
11	Analysis of digital circuits with VHDL (Very High Speed Integrated Circuits Hardware Description Language).	Reading source material and review	Recommended resources
12	Design of asynchronous sequential circuits, critical race-free coding methods.	Reading source material and review	Recommended resources
13	Circuit design with programmable logic elements.	Reading source material and review	Recommended resources
14	Circuit design with programmable logic elements.	Reading source material and review	Recommended resources
15	Fault analysis in digital circuits	Reading source material and review	Recommended resources
16	FINAL EXAM		

Recommended Optional Programme Components

ELK535-2023 Next Digital Circuits

Course Learning Outcomes

No	Learning Outcomes
C01	Performs functional, timing, and power analyses of complex digital circuits.
C02	Designs and implements advanced digital systems using hardware description languages (VHDL, Verilog, etc.).
C03	Conducts synthesis, simulation, and verification processes of FPGA- and ASIC-based digital circuits.
C04	Evaluates and applies speed, area, and power optimizations in digital circuit designs.
C05	Analyzes and critically evaluates emerging digital circuit technologies and research trends.
C06	It evaluates fault conditions in digital circuits.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	12	168
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	7	7
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	8	8
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	1	3	4	4	1	2	2	1	1	1
C01	1	3	3	3	1	2	1	1	1	1
C02	1	3	4	3	1	2	2	1	1	1
C03	1	3	4	4	1	2	2	1	1	1
C04	1	3	4	3	1	4	2	1	1	1
C05	1	3	3	5	1	3	3	1	1	1
C06	1	3	4	4	1	2	2	1	1	1

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK530-2023	Wireless Power Transfer Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK530-2023	Wireless Power Transfer Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
This course provides information on wireless charging technology.
Teaching Methods and Techniques:
Wireless power transmission systems, winding design, for small, medium and large power systems inverter structures, compensation topologies, measurement of electromagnetic emission values ??and current standards, high frequency core selections and core minimization studies.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Emrullah AYDIN
Assistants:

Recommended or Required Reading

Resources

Zhang, Z., & Mi, C. C. (2018). Wireless power transfer for electric vehicles and mobile devices. Wiley-IEEE Press.
Imura, T. (2020). Wireless power transfer. Springer.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Electric vehicle technology		
2	Charging methods of electric vehicles		
3	Wired and wireless charging methods		
4	Application areas of wireless charging methods		
5	Application areas of wireless charging methods		
6	Definition of self inductance and mutual inductance		
7	Derivation of self-inductance and mutual inductance equations		
8	Midterm Exam		
9	Winding design		
10	Inverter structures		
11	Compensation topologies		
12	Measurement of electromagnetic emission values		
13	EMI standards		
14	Core selections and minimization		
15	Efficiency optimization and performance analysis in wireless charging systems		
16	Final Exam		

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	Learns the charging methods of electric vehicles.
C02	Learns wireless charging technology.
C03	Designs and analyzes a small powerful wireless charging system.
C04	Analyzes the efficiency of wireless power transfer systems and applies methods to improve it.
C05	Evaluates the advantages and limitations of wireless charging technology in different application scenarios.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	7	98
Assignments	5	8	40
Presentation	0	0	0
Mid-terms	1	10	10
Practice	3	4	12
Laboratory	0	0	0
Project	2	7	14
Final examination	1	10	10
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	3	3	3	3	4	3	3	2	4
C01	4	3	3	3	3	4	3	3	2	4
C02	4	4	3	4	3	4	3	3	2	4
C03	5	5	4	4	3	5	4	3	3	5
C04	5	5	4	5	3	5	5	3	3	5
C05	4	5	4	5	4	4	4	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK511-2023	Fraction Degree Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK511-2023	Fraction Degree Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to provide the necessary knowledge to understand, analyze and control such systems. is the creation of infrastructure. The topics to be discussed for this purpose are: Includes: Gamma Function, Mittag-Leffler Function, Wright Function, Grünwald-Letnikov Fractional Derivatives, Riemann-Liouville Fractional Derivatives, fractional order Numerical solutions of derivatives and integrals, fractional order systems and controller structures.
Teaching Methods and Techniques:
Overview: History, theory and general applications. Special Functions for Fractional Calculation: Gamma Function, Mittag-Leffler Function, Wright Function. Fractional Derivatives and Integrals: Grünwald-Letnikov Fractional Derivatives, Riemann-Liouville Fractional Derivatives, Some Other Approaches, Fractional Integral and Geometric and Fractional Derivative Physical Interpretation, Consecutive Fractional Derivatives, Left and Right Fractional Derivatives, Fractional Derivatives Properties, Laplace Transforms of Fractional Derivatives, Fourier Transforms of Fractional Derivatives. Linear Fractional Differential Equations: General Fractional Differential Equation Form, Existence and Uniqueness Theorem as a Solution Method, Initial Conditions of a Solution Dependence, Laplace Transform Method, Standard Fractional Differential Equations, Sequential Fractional Differential Equations. Nonlinear Fractional Differential Equations: An Overview of Chaotic Systems. Numerical Solution of Fractional Differential Equations: Initial value problem, Numerical Solution Methods, Numerical Solution Examples. For Fractional Differential Equations "Short Memory" in Initial Value Problems Principle, Adams-Bashforth and Adams- Moulton Methods. Simulation and Real-Time Applications: Fractional order systems and controllers.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Gürkan Kavuran
Assistants:

Recommended or Required Reading

Resources

1. R. Caponetto, G. Dongola, L. Fortuna, and I. Petras, Fractional Order Systems: Modeling and Control Applications, World Scientific, 2010. 2. Z. Jiao, Y.Q. Chen, and I. P
1. I. Podlubny, Fractional Differential Equations, Academic Press, 1999.
2. K. Diethelm, The Analysis of Fractional Differential Equations, Springer, 2010.
3. M.D. Ortigueira, Fractional Calculus for Scientists and Engineers, Lecture Notes in Electrical Engineering, Vol 84, Springer, 2011.
4. C.A. Monje, Y.Q. Chen, B.M. Vinagre, D. Xue, and V. Feliu, Fractional-order Systems and Controls–Fundamentals and Applications, Advanced Industrial Control Series

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Overview: History, theory and general applications.		
2	Special Functions for Fractional Calculation: Gamma Function, Mittag-Leffler Function, WrightFunction.		
3	Special Functions for Fractional Calculation: Gamma Function, Mittag-Leffler Function, WrightFunction.		
4	Fractional Derivatives and Integrals: Grünwald-Letnikov Fractional Derivatives, Riemann-Liouville Fractional Derivatives,Son		
5	Fractional Derivatives and Integrals: Left and Right Fractional Derivatives, Properties of Fractional Derivatives, Fractional D		
6	Linear Fractional Differential Equations: General Fractional Differential Equation Form, Solution MethodExistence and Uniqu		
7	Linear Fractional Differential Equations: Laplace Transform Method, Standard Fractional DifferentialEquations, Consecutive		
8	MİDTERM		
9	Nonlinear Fractional Differential Equations: An Overview of Chaotic Systems.		
10	Nonlinear Fractional Differential Equations: An Overview of Chaotic Systems.		
11	Numerical Solution of Fractional Differential Equations: Initial value problem, Numerical SolutionMethods, Numerical Solutic		
12	Numerical Solution of Fractional Differential Equations: Adams-Bashforth and Adams-Moulton Methods.		
13	MATLAB Applications: Fractional order systems and controllers.		
14	MATLAB Applications: Fractional order systems and controllers.		
15	MATLAB Applications: Fractional order systems and controllers.		
16	Final Exam	-	-

Recommended Optional Programme Components

001-203 ELECTIVE COURSES GROUP

Course Learning Outcomes

No	Learning Outcomes
C01	A student who successfully completes the course understands the nature of fractional order systems.
C02	Performs numerical solutions of fractional order differential equations;
C03	Be aware of the difficulties specific to nonlinear fractional systems.
C04	Can analyze fractional systems using some techniques.
C05	Can design fractional control systems using some techniques.
C06	Will be able to follow other topics and studies related to fractional systems and controls has the infrastructure.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%15
Quizzes	0	%0
Assignment	1	%15
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	10	140
Assignments	1	7	7
Presentation	1	7	7
Mid-terms	1	15	15
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	15	15
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	3	4	5	5	2	4	4	2	2	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK526-2023	Mathematical Methods in Control Engineering				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK526-2023	Mathematical Methods in Control Engineering	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of the course is to first introduce the basic concepts of mathematics and their practical applications to first-year control and automation engineering graduate students. The course emphasizes the connection between the mathematical world and practical reality.
Teaching Methods and Techniques:
Multivariate Analysis, First Order Differential Equations, Linear Differential Equations, Series Solution Methods, Special Functions, Vectors and Tensors, Linear Analysis, Linear Algebra, Dynamic Systems.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Ali YÜCE
Assistants:

Recommended or Required Reading

Resources

Strang, G. (1986). Introduction to applied mathematics. Wellesley-Cambridge Press.
Kaplan, W. (2003). Advanced calculus. Addison-Wesley.

Lopez, R. J. (2001). Advanced engineering mathematics. Addison Wesley Longman.

Strang, G. (1986). Introduction to applied mathematics. Wellesley-Cambridge Press.

Course Category

Mathmatics and Basic Sciences	:	30	**Education**	:	
Engineering	:	30	**Science**	:	
Engineering Design	:	30	**Health**	:	
Social Sciences	:		**Field**	:	10

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Multivariate Analysis		
2	First Order Differential Equations		
3	Linear Differential Equations		
4	Series Solution Methods		
5	Special Functions (Orthogonal Functions and Fourier Series)		
6	Tensors (Cartesian Index Notation, Cartesian Tensors)		
7	Vectors (Vector Algebra, Vector Analysis, Differential Operators, Orthogonal Curvilinear Coordinates)		
8	Midterm		
9	Linear Analysis (Sets, Vector Spaces)		
10	Linear Analysis (Operators, Equations, Weighted Residuals)		
11	Linear Algebra (Definitions and Properties, Matrix Algebra, Eigenvalues ??and Eigenvectors, Orthogonal and Unitary Matrice		
12	Linear Algebra (Matrix Decomposition)		
13	Dynamical Systems (Recursive Maps, Higher Order Scalar Differential Equations, Linear Systems)		
14	Dynamic Systems (Nonlinear Equations, Fracts, Lorenz Equations with Bifurcations)		
15	Numerical Methods and Computational Approaches		
16	Final Exam		

Recommended Optional Programme Components

ELK526-2023 Mathematical Methods in Control Engineering

Course Learning Outcomes

No	Learning Outcomes
C01	Gains in-depth knowledge of mathematical notation and concepts related to vectors, matrices, and analysis.
C02	Reasons mathematically about control system analysis and design problems.
C03	Develops mathematical concepts for solving new problems in the field of control engineering.
C04	Gains the ability to solve differential equations and express system models mathematically.
C05	Analyzes and interprets the behavior of control systems using mathematical methods.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	12	168
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	6	6
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	10	10
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	3	5	3	4	4	3	2	4
C01	5	4	3	5	3	4	4	3	2	4
C02	5	5	4	5	3	4	4	3	3	4
C03	4	5	5	5	3	4	5	3	4	5
C04	5	5	4	5	3	5	4	3	3	4
C05	5	5	4	5	3	5	5	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK519-2023	Machine Learning				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK519-2023	Machine Learning	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of the course is to teach the theoretical subjects about Machine Learning with application examples in different fields.
Teaching Methods and Techniques:
Introduction. Concept learning and general to specific ordering. Decision tree learning. Artificial neural networks. Evaluation of Hypotheses. Bayesian learning. Computational Learning Methods. Sample based learning. Genetic Algorithms. Reinforcement Learning.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Yağmur ÖLMEZ
Assistants:

Recommended or Required Reading

Resources

-,Machine Learning, Tom Mitchell, McGraw-Hill, 1997
Introduction to Machine Learning, Ethem Alpaydin, The MIT Press,2010
Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, 2006
Ders Kitabı, Ders Notları
Ders Notları ve Ders Kitabı
Ara ve Final Sınavı

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 60	**Science**	:
Engineering Design	: 20	**Health**	:
Social Sciences	:	**Field**	: 20

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction.	-	-
2	Concept learning and general to specific ordering.	-	-
3	Decision tree learning.	-	-
4	Decision tree learning.	-	-
5	Artificial neural networks.	-	-
6	Artificial neural networks.	-	-
7	Evaluation of Hypotheses.	-	-
8	Midterm Exam		
9	Bayesian learning.	-	-
10	Bayesian learning.	-	-
11	Computational Learning Methods.	-	-
12	Computational Learning Methods.	-	-
13	Sample based learning.	-	-
14	Genetic Algorithms.	-	-
15	Reinforcement Learning.	-	-
16	Final Exam		

Course Learning Outcomes

No	Learning Outcomes
C01	Explains the fundamental concepts and algorithms of machine learning.
C02	Performs data preprocessing, feature selection, and analyzes datasets.
C03	Applies supervised and unsupervised learning algorithms and evaluates the results.
C04	Performs model selection, validation, and hyperparameter optimization.
C05	Applies machine learning methods to real-world problems and interprets the outcomes.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	41	41
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	3	4	3	4	4	2	3	4
C01	4	5	4	4	3	5	5	2	3	4
C02	4	4	4	4	3	5	5	2	3	4
C03	3	4	4	5	3	5	5	2	3	4
C04	3	4	4	5	3	5	5	2	3	4
C05	4	4	4	4	4	5	5	3	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK517-2023	Center Pattern Generators				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK517-2023	Center Pattern Generators	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
Design and implementation of intelligent neural structures to model the movements of robotic systems developed with biomimetic design approach.
Teaching Methods and Techniques:
Introduction to Biomimetic Systems, Spinal Nerve Cells and Oscillators, Amplitude Controlled Phase Oscillator, Hopf Oscillator, Matsuoka Oscillator, SO-2 Networks, Lamprey Oscillator Model, Van Der Pol and Wilson-Cowan Oscillators, Fitzhugh-Nagumo Oscillator, Koatik Oscillator Models, Oscillator Design and Modelling, Modelling of Oscillators with MATLAB, Modelling of Rhythmic Movements in Robotic Systems.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Deniz KORKMAZ
Assistants:

Recommended or Required Reading

Resources	INTRODUCTION TO ROBOTICS - Mechanics and Control Instructor notes. Ders Kitabı, Ders Notları, Ödevler Ders Notları ve Ders Kitabı Ara ve Final Sınavı

Course Category

Mathmatics and Basic Sciences	:	30	**Education**	:	
Engineering	:	50	**Science**	:	
Engineering Design	:		**Health**	:	
Social Sciences	:		**Field**	:	20

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to Biomimetic Systems		
2	Spinal Cord Nerve Cells and Oscillators		
3	Amplitude Controlled Phase Oscillator		
4	Amplitude Controlled Phase Oscillator		
5	Hopf Oscillator		
6	Matsuoka Oscillator		
7	SO-2 Networks		
8	MIDTERM EXAM		
9	Lamprey Oscillator Model		
10	Van Der Pol and Wilson-Cowan Oscillators		
11	Fitzhugh-Nagumo Oscillator, Coatic Oscillator Models		
12	Oscillator Design and Modelling		
13	Modelling of Oscillators with MATLAB		
14	Modelling Rhythmic Movements in Robotic Systems		
15	Modelling Rhythmic Movements in Robotic Systems		
16	SEMESTER FINAL EXAM		

Course Learning Outcomes

No	Learning Outcomes
C01	Explains the fundamental concepts and biological basis of central pattern generators.
C02	Develops mathematical models of central pattern generators.
C03	Applies and simulates central pattern generators for robotic movements.
C04	Designs and evaluates robotic control strategies using central pattern generators.
C05	Implements central pattern generators on different robotic platforms and interprets their performance.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	41	41
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	3	4	3	4	3	2	3	4
C01	4	4	4	4	3	5	4	2	3	4
C02	4	4	4	5	3	5	5	2	4	4
C03	4	4	5	5	3	5	5	3	4	5
C04	4	4	4	4	4	5	5	3	5	5
C05	4	4	4	4	5	5	3	5	5	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK532-2023	Programmable Electronic Arrays				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK532-2023	Programmable Electronic Arrays	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to develop the competence to compare programmable digital architectures, define finite state machines using Verilog, and analyze FPGA input/output configurations.
Teaching Methods and Techniques:
Programmable digital architectures; Moore and Mealy machines; timing; Verilog; finite state machines; memories and logic arrays; bus controllers; FPGA I/O configurations and analysis of test results.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Mehmet ÜSTÜNDAĞ
Assistants:

Recommended or Required Reading

Resources abaey, Jan M., Anantha P. Chandrakasan, and Borivoje Nikolic. Digital integrated circuits. Vol. 2. Englewood Cliffs: Prentice hall, 2002.
The textbook for the course is Weste & Harris, CMOS VLSI Design: A Circuits and
Systems Perspective, 3rd ed, Addison Wesley, 2005

Course Category

Mathmatics and Basic Sciences	:		**Education**	:	
Engineering	:	40	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	40

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction, Digital circuits	Reading source material and review	Recommended resources
2	Moore type design	Reading source material and review	Recommended resources
3	Mealy type design	Reading source material and review	Recommended resources
4	What are sequential circuits and timing in these circuits?	Reading source material and review	Recommended resources
5	Verilog components for pipelined circuits	Reading source material and review	Recommended resources
6	Defining finite state machines with Verilog	Reading source material and review	Recommended resources
7	Defining finite state machines with Verilog	Reading source material and review	Recommended resources
8	MIDTERM		
9	Memories and their usage, read-only memory, programmable logic arrays.	Reading source material and review	Recommended resources
10	Memories and their usage, read-only memory, programmable logic arrays.	Reading source material and review	Recommended resources
11	Finite state machines with data paths and their definition with Verilog	Reading source material and review	Recommended resources
12	Using the input output modules of the Xilinx Spartan starter kit.	Reading source material and review	Recommended resources
13	Using the input output modules of the Xilinx Spartan starter kit.	Reading source material and review	Recommended resources
14	Using the input output modules of the Xilinx Spartan starter kit	Reading source material and review	Recommended resources
15	Application and Examples	Reading source material and review	Recommended resources
16	FINAL EXAM		

Recommended Optional Programme Components

ELK536-2023 Advanced Analog All Circuits

Course Learning Outcomes

No	Learning Outcomes
C01	It compares the architectures of programmable digital structures.
C02	Designs Moore and Mealy machines according to the given behavioral specification.
C03	It analyzes the timing conditions of sequential circuits.
C04	Defines the finite state machine using Verilog.
C05	Selects memory and programmable logic structures according to design requirements.
C06	It explains the configuration of FPGA input/output units using Verilog.
C07	It evaluates the correctness of the FPGA design based on the provided test results.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	11	154
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	14	14
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	15	15
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	1	3	3	4	1	3	2	1	1	1
C01	1	2	2	5	1	2	1	1	1	1
C02	1	3	5	4	1	3	2	1	1	1
C03	1	3	3	4	1	2	2	1	1	1
C04	1	3	3	4	1	4	2	1	1	1
C05	1	3	4	5	1	3	2	1	1	1
C06	1	2	2	3	1	3	1	1	1	1
C07	1	3	3	5	1	3	3	1	1	1

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK518-2023	Robotic Systems				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK518-2023	Robotic Systems	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
Introducing the most basic features, definitions, design and control principles of robot technologies Giving preliminary information for the solution of complex robot design problems
Teaching Methods and Techniques:
Introduction to robots, Kinematics of robots, Homogeneous and Inverse kinematic transformations, Workspace analysis, Orbital planning, Static and dynamics of robots, Control of robots, Robot programming methods and languages, Special topics
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Deniz KORKMAZ
Assistants:

Recommended or Required Reading

Resources

Robot Analysis and control, H. ASADA and J.J.E.SLOTINE, Wiley-Interscience, 1986.,Fundementals of Robotics, R.J.SCHILLING, Prentice Hall, 1990
Robot Analysis and control, H. ASADA and J.J.E.SLOTINE, Wiley-Interscience, 1986.
Fundementals of Robotics, R.J.SCHILLING, Prentice Hall, 1990
Ders Kitabı, Ders Notları, Ödevler
Ders Notları ve Ders Kitabı
Ara ve Final Sınavı

Course Category

Mathmatics and Basic Sciences	:	10	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	30	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Definition of Robots, Classification, Robot Characteristics		
2	Kinematics of Robots		
3	Rotational Movement, Homogeneous Transformations		
4	Inverse Kinematic Transformations		
5	Workspace Analysis and Orbital Planning		
6	Differential Motion and Static of Robots		
7	Manipulator Dynamics and Lagrange Equations		
8	MIDTERM		
9	Control of Robots		
10	Uniaxial PID Control		
11	Calculated Torque Control		
12	Variable Structure Control		
13	Robot Programming Methods		
14	Robot Programming Languages and Special Topics		
15	Robot Programming Languages and Special Topics		
16	Final Exam		

Recommended Optional Programme Components

ELK521-2023 Modeling and Control of Electromechanical Systems

Course Learning Outcomes

No	Learning Outcomes
C01	Explains the basic components and operating principles of robotic systems.
C02	Develops mathematical models for robot kinematics and dynamics.
C03	Solves forward and inverse kinematics problems.
C04	Applies robot control methods and evaluates their performance.
C05	Designs robotic applications by integrating sensing and decision-making components.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	41	41
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	3	4	3	4	3	2	3	4
C01	4	4	4	4	3	5	4	2	3	4
C02	4	4	5	3	5	4	2	4	4	4
C03	4	5	5	3	5	5	2	4	4	4
C04	4	4	5	5	3	5	5	2	4	4
C05	4	4	4	4	4	5	5	3	5	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK501-2023	Numeric Filters				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK501-2023	Numeric Filters	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to teach students the theoretical foundations and practical applications of digital filters and to equip them with the knowledge and skills to develop solutions to modern signal processing problems. By the end of the course, students will understand how to use digital filters in complex signal processing systems and will be able to apply this knowledge in fields such as telecommunications, audio processing and biomedical engineering.
Teaching Methods and Techniques:
In the digital filters course, students are introduced to basic digital signal processing principles and digital filter design techniques. The course focuses on mathematical tools such as the Z-transform, Fourier transform and fast Fourier transform (FFT), as well as the design, implementation and analysis of FIR and IIR filters. Additionally, students learn to implement real-time applications of digital filters using software such as MATLAB.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Prof. Dr. Melih Cevdet İNCE
Assistants:

Recommended or Required Reading

Resources

Proakis, J. G. (2007). Digital signal processing: principles, algorithms, and applications, 4/E. Pearson Education India.
1. Ludeman, L. C. (1986). Digital signal processing. Addison-Wesley Longman Publishing Co., Inc.
2. Oppenheim, A. V. (1999). Discrete-time signal processing. Pearson Education India.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	50	**Science**	:	
Engineering Design	:	30	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Signals and Systems in the Time Domain		
2	Time Domain Analysis		
3	Frequency Domain Analysis		
4	Z-Transform		
5	Z-Transform		
6	Design of Digital Filters - FIR Filters		
7	Design of Digital Filters - IIR Filters		
8	Midterm Exam		
9	Digital Filter Structures		
10	Fast Fourier Transform (FFT)		
11	Power Spectrum and Spectral Estimation		
12	Adaptive Filters		
13	Multirate Digital Signal Processing		
14	Multirate Digital Signal Processing		
15	Special Topics and Applications		
16	Final Exam		

Recommended Optional Programme Components

ELK502-2023 Filter Design Methods

Course Learning Outcomes

No	Learning Outcomes
C01	Recognizes the fundamental properties and characteristics of digital signals and performs operations on them.
C02	Understands how analog signals are transferred into the digital domain and the fundamental principles of the sampling theorem.
C03	Uses the discrete Fourier transform to perform frequency domain analysis of signals.
C04	Identifies the types of filters required for different applications.
C05	Designs digital filters and evaluates their performance.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	15	3	45
Hours for off-the-c.r.stud	5	4	20
Assignments	5	2	10
Presentation	0	0	0
Mid-terms	1	30	30
Practice	3	4	12
Laboratory	0	0	0
Project	2	4	8
Final examination	2	50	100
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	3	4	3	4	3	3	2	4
C01	5	4	3	4	3	4	3	3	2	4
C02	5	4	3	4	3	4	3	3	2	4
C03	5	5	4	5	3	5	4	3	3	5
C04	4	5	4	4	3	4	4	3	3	5
C05	5	5	4	5	3	5	5	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK503-2023	DigitalImage Processing				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK503-2023	DigitalImage Processing	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
To have and apply basic knowledge about image structure, image processing methods and information extraction from images.
Teaching Methods and Techniques:
Fundamentals of the image; Image detection and acquisition; Image enhancement; Image filtering; Image Matching; Color space; Geometric transformations; Object capture and extraction methods; Image segmentation-classification methods
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Prof. Dr. Melih Cevdet İNCE
Assistants:

Recommended or Required Reading

Resources

Russ, J. C. (2007). The image processing handbook. Taylor & Francis Group.,Gonzales, R. C., & Woods, R. E. (2008). Digital image processing. Pearson.
1) Jähne, B. (2005). Digital image processing. Springer-Verlag Berlin Heidelberg.
2) Pratt, W. K. (2002). Digital image processing: PIKS inside. John Wiley & Sons, Inc.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 40	**Science**	:
Engineering Design	: 40	**Health**	:
Social Sciences	:	**Field**	: 20

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Basic definitions and concepts about images and image processing		
2	Image detection and recording		
3	Image enhancement techniques		
4	Image enhancement techniques		
5	Image filtering techniques		
6	Morphological filters		
7	Image Matching		
8	Midterm Exam		
9	color space		
10	Geometric Transformations		
11	Geometric Transformations		
12	Object capture and extraction methods		
13	Object capture and extraction methods		
14	Image segmentation-classification methods		
15	Image segmentation-classification methods		
16	Final Exam		

Recommended Optional Programme Components

ELK501-2023 Numeric Filters

Course Learning Outcomes

No	Learning Outcomes
C01	It defines the most suitable image for solving the image processing problem, based on the relationship between the radiometric, geometric and spectral resolutions of the images.
C02	It determines which image processing operator can be used in which problem.
C03	Applies basic image processing operators to solve image processing problems.
C04	Compares the basic image processing operators needed to solve image processing problems.
C05	Offers solutions to solve image processing problems.
C06	Evaluates the applicability of basic image processing operators.
C07	Writes effective reports and understands written reports, and prepares design and production reports.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	41	41
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	3	4	3	4	3	3	2	4
C01	5	4	3	4	3	4	3	3	2	4
C02	5	5	4	5	3	5	4	3	3	4
C03	5	5	4	5	3	5	5	3	3	5
C04	4	5	4	4	3	4	4	3	3	5
C05	4	5	4	4	3	4	5	3	3	5
C06	5	5	4	5	3	5	5	3	3	5
C07	4	4	3	4	5	4	4	4	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK516-2023	Numeric Control				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK516-2023	Numeric Control	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
Understanding the modeling of Numerical Control Systems, Signal sampling and Shannon's Theorem. Understanding the behavioral characteristics of poles in the Z plane, frequency response and geometric location of roots. Learning PID and RST type control methods with stability analysis of numerical control systems.
Teaching Methods and Techniques:
Revision of continuous-time control systems. Introduction of numerical control systems. Signal sampling and Shannon's theorem. Z transform. Difference equations. Discrete-time state equations. Discrete time transfer function. Stability of discrete-time systems. Nyquist criteria. PID controller design in Z plane. RST controller design.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Ali YÜCE
Assistants:

Recommended or Required Reading

Resources	Kuo, B. C. (1995). Digital control systems. Oxford University Press. Ogata, K. (2010). Modern control engineering (5th ed.). Prentice Hall. Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:		**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	40	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Continuous-time control systems		
2	Structures and principles of numerical control systems		
3	Components of numerical control systems		
4	Signal sampling and Shannon's theorem		
5	Z transform		
6	Discrete-time equations of state		
7	Discrete-time equations of state		
8	Midterm Exam		
9	Discrete-time transfer function		
10	Discrete-time transfer function		
11	Stability of linear discrete-time systems		
12	Controller design in the complex plane		
13	Zero-pole simplification, Feedforward		
14	Parallel and cascade structures		
15	General review, application examples		
16	Final Exam		

Recommended Optional Programme Components

ELK526-2023 Mathematical Methods in Control Engineering

Course Learning Outcomes

No	Learning Outcomes
C01	Defines the fundamental characteristics of digital control systems.
C02	Converts continuous-time dynamic system models into discrete time.
C03	Performs stability analysis using frequency response.
C04	Designs controllers in the complex plane.
C05	Evaluates the performance of the designed digital controllers and interprets the system responses.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	12	168
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	6	6
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	10	10
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	4	5	4	3	2	1	2	3
C01	5	4	3	4	3	3	2	1	2	3
C02	5	5	4	4	3	4	3	1	2	3
C03	5	5	4	5	4	4	4	2	3	4
C04	5	5	5	5	4	4	4	2	3	4
C05	5	5	5	5	5	5	5	2	4	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK504-2023	DigitalAudio Processing				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK504-2023	DigitalAudio Processing	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to examine the properties of speech signals in the time and frequency domain, and to provide students with the ability to apply basic signal processing methods to speech signals.
Teaching Methods and Techniques:
Basic Digital Signal Processing concepts, Human hearing mechanism, Speech and sound perception, Modeling of sound signals, Short-term analysis of speech, Time environment analysis, Short-term Fourier analysis, Improvement of Speech and Voice signals, Noise separation, Feature extraction in Speech and Voice signals, Linear Predictive analysis of speech signals, Estimation of speech parameters, Pitch frequency and Formant estimation, Calculation of Mel-Scale Cepstrum coefficients, Voice Recognition Methods, Vector Quantization Algorithm, Automatic Speech recognition, Hidden Markov Models, Voice coding and compression methods
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Prof. Dr. Melih Cevdet İNCE
Assistants:

Recommended or Required Reading

Resources

Rabiner, L. R., & Shafer, R. W. (2010). Theory and applications of digital speech processing. Prentice Hall.
Gold, B., Morgan, N., & Ellis, D. (2011). Speech and audio signal processing: Processing and perception of speech and music (2nd ed.). Wiley.
3

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 30	**Science**	:
Engineering Design	: 40	**Health**	:
Social Sciences	:	**Field**	: 30

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to Digital Speech and Voice Processing		
2	Review of Digital Signal Processing concepts		
3	Human hearing mechanism, Speech and sound perception		
4	Modeling of sound signals, Short-term analysis of speech		
5	Time history analysis, Short term Fourier analysis		
6	Improvement of Speech and Voice signals, Noise decomposition Improvement of Speech and Voice signals, Noise decompc		
7	Feature extraction in speech and audio signals		
8	Midterm Exam		
9	Linear Predictive analysis of speech signals		
10	Estimation of speech parameters, Pitch frequency and Formant estimation		
11	Calculation of Mel-Scale Cepstrum coefficients		
12	Voice Recognition Methods, Vector Quantization Algorithm		
13	Automatic Speech recognition, Hidden Markov Models		
14	Audio coding and compression methods		
15	Audio coding and compression methods		
16	Final Exam		

Recommended Optional Programme Components

ELK501-2023 Numeric Filters

Course Learning Outcomes

No	Learning Outcomes
C01	Understands the human voice production and hearing mechanisms.
C02	Analyzes speech and sound signals.
C03	Learns methods of encoding and compression of speech signals.
C04	Learns about automatic speech recognition system.
C05	Develops applications related to speech and voice.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	41	41
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	3	4	3	3	3	2	2	4
C01	5	4	3	4	3	3	3	2	2	4
C02	5	5	4	5	3	4	4	3	3	5
C03	5	4	4	4	3	4	4	3	3	5
C04	5	4	4	4	3	4	4	3	3	5
C05	5	5	4	5	4	5	5	3	4	5

Program Learning Outcomes	
No	**Learning Outcome**
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria		
In-Term Studies	**Quantity**	**Percentage**
Mid-terms	0	%0
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	0	%0
Total		**%0**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration**	**Total Work Load**
Course Duration	0	0	0
Hours for off-the-c.r.stud	0	0	0
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	0	0	0
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	0	0	0
Total Work Load			**0**
ECTS Credit of the Course			**0**

Contribution of Learning Outcomes to Programme Outcomes



Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK103-2023	Seminar				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK103-2023	Seminar	1	0	5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Required
Objectives of the Course:
The aim is to provide the student with the ability to conduct scientific research and present his/her work on related topics as preparation for the thesis topic.
Teaching Methods and Techniques:
To conduct a literature review as a preliminary study on the thesis topic determined with his/her advisor and to prepare a presentation by evaluating the information obtained.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Undefined Tüm danışmanlar
Assistants:

Recommended or Required Reading

Resources
Library and internet environment,Thesis writing guide
Meeting with thesis advisor
kütüphaneler internet ortamı
Seminer
Sunum

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	0
Engineering	:	50	**Science**	:	10
Engineering Design	:	20	**Health**	:	0
Social Sciences	:	0	**Field**	:	0

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Identifying the topic to be researched		
2	Literature review		
3	Literature review		
4	Literature review		
5	Meeting with advisor		
6	Meeting with advisor		
7	Evaluation of the information obtained		
8	Meeting with advisor		
9	Re-evaluating and correcting the prepared work		
10	Write the seminar in accordance with the spelling rules		
11	Meeting with advisor		
12	Meeting with advisor		
13	Presenting the seminar to the audience and answering questions		
14	Discussing the results of the seminar with the advisor		

Course Learning Outcomes

No	Learning Outcomes
C01	Learn to search the literature.
C02	Interprets the information obtained from the literature.
C03	Knows where to find information and publications on the subject of study.
C04	Determines what new research topics are in the field of study.
C05	Gains the ability to explain and discuss the presentation prepared.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	0	%0
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	1	%100
Project	0	%0
Final examination	0	%0
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	1	14
Hours for off-the-c.r.stud	14	7	98
Assignments	0	0	0
Presentation	1	20	20
Mid-terms	0	0	0
Practice	1	20	20
Laboratory	0	0	0
Project	0	0	0
Final examination	0	0	0
Total Work Load			**152**
ECTS Credit of the Course			**5**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	3	4	3	2	4	3	2	4
C01	4	4	3	4	3	2	4	3	2	4
C02	4	4	3	4	3	3	4	3	2	4
C03	4	4	3	4	3	3	4	3	2	4
C04	4	4	4	4	3	3	5	3	3	5
C05	4	4	3	4	5	3	4	4	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK531-2023	Noise Reduction Algorithms in Signal Processing				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK531-2023	Noise Reduction Algorithms in Signal Processing	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of this course is to provide the competence to distinguish between signal and noise characteristics, theoretically analyze noise reduction algorithms, and evaluate the performance of wavelet-based methods.
Teaching Methods and Techniques:
Signal and noise types; statistical properties; noise reduction methods; wavelet transform; coefficient thresholding; numerical examples; performance evaluation using error metrics and signal-to-noise ratio.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Mehmet ÜSTÜNDAĞ
Assistants:

Recommended or Required Reading

Resources Saeed V. Vaseghi (2008) Advanced Digital Signal Processing and Noise Reduction
Saeed V. Vaseghi (2008) Advanced Digital Signal Processing and Noise Reduction

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 20	**Science**	:
Engineering Design	: 40	**Health**	:
Social Sciences	:	**Field**	: 40

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	The concept of a signal and classification	Reading source material and review	Recommended resources
2	Basic characteristics of signals	Reading source material and review	Recommended resources
3	Noise types	Reading source material and review	Recommended resources
4	Statistical properties of noise	Reading source material and review	Recommended resources
5	Noise removal algorithms	Reading source material and review	Recommended resources
6	Comparison of methods	Reading source material and review	Recommended Documents
7	Fundamentals of wavelet transform	Reading source material and review	Recommended resources
8	MIDTERM		
9	Multiresolution wavelet analysis	Reading source material and review	Recommended Documents
10	Denoising using wavelet coefficients	Reading source material and review	Recommended resources
11	Thresholding and parameter effectsl	Reading source material and review	Recommended Documents
12	Numerical example of noise reduction	Reading source material and review	Recommended Resources
13	Error metrics and signal-to-noise ratio	Reading source material and review	Recommended Documents
14	Result analysis for different noises	Reading source material and review	Recommended resources
15	Comparison and interpretation of the results	Reading source material and review	Recommended Resources
16	FINAL EXAM		

Recommended Optional Programme Components

ELK504-2023 DigitalAudio Processing

Course Learning Outcomes

No	Learning Outcomes
C01	It classifies signals based on their fundamental characteristics.
C02	Distinguishes between noise types based on their statistical properties.
C03	It compares noise removal methods in terms of their assumptions and conditions of use.
C04	Calculates the wavelet transform of a signal.
C05	Calculates thresholded coefficients for wavelet-based noise reduction.
C06	It evaluates noise reduction performance using error metrics and the signal-to-noise ratio.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	12	168
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	7	7
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	8	8
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	1	3	3	4	1	2	2	1	1	1
C01	1	2	1	2	1	1	1	1	1	1
C02	1	3	2	3	1	1	2	1	1	1
C03	1	3	4	5	1	2	2	1	1	1
C04	1	3	3	3	1	2	2	1	1	1
C05	1	3	4	3	1	2	2	1	1	1
C06	1	3	3	5	1	3	3	1	1	1

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK523-2023	System Dynamics Modeling and Simulation				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK523-2023	System Dynamics Modeling and Simulation	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
To provide students with knowledge and skills in the mathematical modeling of systems, the analysis of linear system dynamics, and the evaluation of transient and steady-state responses, as well as to enable them to analyze system behavior using differential equations and mathematical modeling techniques.
Teaching Methods and Techniques:
Introduction to Mathematical Modeling and System Identification, Mechanical Systems, Heat and Fluid Flow Models, Linearization and Scaling, Electrical Systems and System Elements, Mathematical Models of Electrical Circuits, Demonstration of the Similarity of Electrical and Mechanical Systems, Analysis of Mechanical, Thermal and Hydraulic Systems by Modeling with Electrical Circuits, Linear n. Order Differential Equation Models, First Order Systems, Step Response, Ramp Response, Frequency Response, First Order Electrical Systems, Hybrid Systems, Second Order Systems, Mechanical Second Order Systems, Electrical Second Order Systems.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Ali YÜCE
Assistants:

Recommended or Required Reading

Resources

Ogata, K. (2004). System dynamics (4th ed.). Prentice Hall.
Palm, W. J. (1999). Modeling, analysis, and control of dynamic systems (2nd ed.). John Wiley & Sons.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	10	**Education**	:	
Engineering	:	20	**Science**	:	
Engineering Design	:	40	**Health**	:	
Social Sciences	:		**Field**	:	30

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Introduction to Mathematical Modeling and System Identification		
2	Mechanical Systems		
3	Heat and Fluid Flow Models, Linearization and Scaling		
4	Electrical Systems and System Elements, Mathematical Models of Electrical Circuits		
5	Demonstrating the Similarity of Electrical and Mechanical Systems		
6	Analysis of Mechanical, Thermal and Hydraulic Systems by Modeling them with Electrical Circuits		
7	Model Validation and Simulation Techniques		
8	Midterm Exam		
9	First Order Systems		
10	First Order Systems		
11	Step Response, Ramp Response, Frequency Response		
12	First Order Electrical Systems, Hybrid Systems		
13	Second Order Systems		
14	Mechanical Second Order Systems		
15	Electrical Second Order Systems		
16	Final Exam		

Recommended Optional Programme Components

ELK505-2023 Dynamics and Control of Power Systems

Course Learning Outcomes

No	Learning Outcomes
C01	Demonstrates in-depth knowledge of mathematical modelling. Creates mathematical models of industrial systems.
C02	Understands the concept of system response.
C03	Interprets the behavior of higher-order systems.
C04	Analyzes the effects of system parameters on dynamic response.
C05	Tests the modeling results using simulation tools and interprets the outcomes.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	12	168
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	6	6
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	10	10
Total Work Load			**226**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	5	5	4	4	5	4	2	3	4
C01	5	5	4	5	4	5	4	2	3	4
C02	4	4	3	4	3	4	3	2	2	3
C03	4	4	4	5	4	4	4	2	3	4
C04	5	5	4	5	4	5	4	2	3	4
C05	4	4	4	5	5	5	5	2	4	4

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK529-2023	Finite Element Analysis Method				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK529-2023	Finite Element Analysis Method	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
This course aims to provide students with fundamental knowledge of the finite element analysis method and to equip them with the ability to apply this method to solve engineering problems.
Teaching Methods and Techniques:
Design, analysis and analysis of electrical machines using the finite element analysis method. modelling. Appropriate networking method selection and implementation. Static, eddy and transient state performing analyses. Parametric and traditional optimization techniques use of.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Asist Prof. Dr. Emrullah AYDIN
Assistants:

Recommended or Required Reading

Resources

Cook, R. D., Malkus, D. S., Plesha, M. E., & Witt, R. J. (2002). Concepts and applications of finite element analysis (4th ed.). Wiley.
Koutromanos, I., McClure, J., & Roy, C. (2018). Fundamentals of finite element analysis: Linear finite element analysis. Wiley.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	20	**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	20	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Fundamentals of the finite element analysis method		
2	Fundamentals of the finite element analysis method		
3	Fundamentals of the finite element analysis method		
4	Fundamentals of finite element analysis method Overview of commercially available SEA software programs		
5	2D design and analysis methods		
6	2D design and analysis methods		
7	Appropriate networking method selection and implementation		
8	Midterm Exam		
9	Performing static, eddy and transient analysis		
10	Performing static, eddy and transient analysis		
11	Performing static, eddy and transient analysis		
12	Use of parametric and traditional optimization techniques		
13	Use of parametric and traditional optimization techniques		
14	Modeling and analysis of an electrical machine with SEA program		
16	Final Exam		

Recommended Optional Programme Components

ELK534-2023 Modeling of Electronic Elements

Course Learning Outcomes

No	Learning Outcomes
C01	Learns the basics of the finite element method.
C02	Learns the use of a finite element analysis program.
C03	Learns modeling and analysis of an electrical machine.
C04	Interprets and evaluates the results obtained using the finite element method.
C05	Applies finite element analysis under different operating conditions and compares the results.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	7	98
Assignments	5	6	30
Presentation	0	0	0
Mid-terms	1	10	10
Practice	3	6	18
Laboratory	0	0	0
Project	2	6	12
Final examination	1	15	15
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	3	5	3	4	4	3	2	4
C01	5	4	3	5	3	4	4	3	2	4
C02	4	4	4	4	3	5	4	3	3	4
C03	5	5	4	4	3	5	5	3	3	5
C04	5	5	4	5	3	5	5	3	3	5
C05	5	5	5	5	4	5	5	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK101-2023	Thesis Management				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK101-2023	Thesis Management	1	0	25

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Required
Objectives of the Course:
It is aimed to discuss the new developments in the subjects of interest of the graduate students in the thesis period.
Teaching Methods and Techniques:
Evaluation of the study subjects of postgraduate students in the thesis period and current developments in these subjects, following the relevant scientific publications.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Undefined Tüm Danışmanlar
Assistants:

Recommended or Required Reading

Resources
Articles related to master's thesis
Articles about master's thesis

Tez Kitabı Yazma
Tez Savunma Sınavı

Course Category

Mathmatics and Basic Sciences	:		**Education**	:	
Engineering	:	60	**Science**	:	
Engineering Design	:	40	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Master thesis work		
2	Master thesis work		
3	Master thesis work		
4	Master thesis work		
5	Master thesis work		
6	Master thesis work		
7	Master thesis work		
8	Master thesis work		
9	Master thesis work		
10	Master thesis work		
11	Master thesis work		
12	Master thesis work		
13	Master thesis work		
14	Master thesis work		

Recommended Optional Programme Components

ELK102-2023 Specialization Course

Course Learning Outcomes

No	Learning Outcomes
C01	Develops and deepens their knowledge in the relevant program area.
C02	Discusses and comments on topics related to the study subject.
C03	Follows the literature related to the study subject and learns the rules of thesis writing.
C04	Learns to use different sources to reach up-to-date information.
C05	Presents scientific research results effectively in written and oral form.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership wher
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	0	%0
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	1	%100
Project	0	%0
Final examination	0	%0
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	10	140
Assignments	14	10	140
Presentation	14	10	140
Mid-terms	0	0	0
Practice	14	5	70
Laboratory	10	9	90
Project	14	10	140
Final examination	0	0	0
Total Work Load			**762**
ECTS Credit of the Course			**25**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	5	4	5	3	4	4	3	3	5
C01	5	5	4	5	3	4	4	3	3	5
C02	4	4	3	4	5	3	4	4	4	5
C03	5	4	3	4	3	3	4	3	3	5
C04	4	4	3	4	3	3	4	3	3	5
C05	4	4	3	4	5	3	4	4	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK102-2023 **Specialization Course**

Semester	Course Unit Code	Course Unit Title	L+P	Credit	Number of ECTS Credits
1	ELK102-2023	Specialization Course	3	0	5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Required
Objectives of the Course:
Providing necessary consultancy services to graduate students during the education process
Teaching Methods and Techniques:
Literature review, latest literature information about the thesis, discussion about the thesis studies, problem solving
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Undefined Tüm Danışmanlar
Assistants:

Recommended or Required Reading

Resources
Thesis studies, articles downloaded from different publishing houses.
Thesis studies, articles downloaded from different publishing houses.
-
-
-

Course Category

Mathmatics and Basic Sciences	: 0	**Education**	: 0
Engineering	: 100	**Science**	: 0
Engineering Design	: 0	**Health**	: 0
Social Sciences	: 0	**Field**	: 0

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Carrying out literature studies		
2	Carrying out literature studies		
3	Carrying out literature studies		
4	Gaining knowledge on thesis		
5	Gaining knowledge on thesis		
6	Gaining knowledge on thesis		
7	Gaining knowledge on thesis		
8	Gaining knowledge on thesis		
9	Gaining knowledge on thesis		
10	Software and hardware infrastructure studies to be used in the thesis study		
11	Software and hardware infrastructure studies to be used in the thesis study		
12	Software and hardware infrastructure studies to be used in the thesis study		
13	Software and hardware infrastructure studies to be used in the thesis study		
14	Software and hardware infrastructure studies to be used in the thesis study		

Course Learning Outcomes

No	Learning Outcomes
C01	Solves a defined problem using appropriate scientific methods.
C02	Evaluates, interprets, and utilizes data related to the research topic at an advanced level of expertise.
C03	Determines and applies methods for solving the problem under study and interprets the results.
C04	Collects, analyzes, and applies data related to the research topic.
C05	Evaluates the research results related to the thesis topic.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	0	%0
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	1	%100
Project	0	%0
Final examination	0	%0
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	0	0	0
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	0	0	0
Practice	0	0	0
Laboratory	14	8	112
Project	0	0	0
Final examination	0	0	0
Total Work Load			**154**
ECTS Credit of the Course			**5**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	5	5	4	3	4	5	3	3	5
C01	5	5	5	4	3	4	5	3	3	5
C02	5	5	5	5	3	4	5	3	3	5
C03	5	5	5	5	3	4	5	3	3	5
C04	5	5	4	5	3	4	5	3	3	5
C05	5	5	4	5	3	4	5	3	3	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK514-2023	Artificial neural networks				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
1	ELK514-2023	Artificial neural networks	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
In this course, the widely used models and algorithms of Artificial Neural Networks (ANN) are explained. Basic neural cell model, perceptron, adaptive linear element, least squares algorithm, Multilayer Perceptron (MLP), Backpropagation (BP) learning algorithm, Radial Based Function (RBF) networks, self-organizing network, vector quantization learning network; Subjects such as Support Vector Machines (SVM), Continuous time and discrete time Hopfield networks, classification techniques, pattern recognition, signal processing and control applications are examined.
Teaching Methods and Techniques:
Introduction to artificial neural networks, artificial neural cell, structure and basic elements of artificial neural networks, artificial neural network tools (matlab), machine learning, reinforced and non-reinforced learning, single layer sensors, multilayer perceptrons, other artificial neural network models, back propagation, application areas of artificial neural networks, neural networks and controller design, application examples.
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Deniz KORKMAZ
Assistants:

Recommended or Required Reading

Resources
1- Artificial Neural Networks Lecture Notes,2- Artificial Neural Networks Book, Prof. Dr. Ercan Oztemel,3- Fundamentals of Neural Networks
1- Artificial Neural Networks Lecture Notes
2- Artificial Neural Networks Book, Prof. Dr. Ercan Oztemel
3- Fundamentals of Neural Networks
1- Yapay Sinir Ağları Ders Notları 2- Yapay Sinir Ağları Kitabı, Prof. Dr. Ercan Öztemel 3- Fundamentals of Neural Networks
Uygulama örnekleri ve Matlab ödevleri
Ara sınav ve yarı yıl sonu sınavı

Course Category

Mathmatics and Basic Sciences	:	10	**Education**	:	
Engineering	:	40	**Science**	:	
Engineering Design	:	50	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Biological inspiration. Historical notes on artificial neural networks. Applications of artificial neural networks. A classification	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
2	General artificial neural cell model. Discrete-valued perceptron, threshold logic and boundaries. Discrete time (dynamic) Hc	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
3	Eğiticili öğrenme. Algılayıcı öğrenme kuralı. Doğrusal uyarlanır eleman. Çıkış hatası minimizasyon problemi olarak eğiticili öğ	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
4	Single layer continuous valued perceptron. Nonlinear (sigmoidal) activation function. The delta rule. Group and data based	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
5	Multilayer perceptron as a universal approximation machine. Function representation and approximation problem. Back pro	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
6	Test set against training set. Overfitting problem. Practical issues in training and testing networks. Signal processing and p	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
7	Radial Base Function (RTF) networks. Back propagation algorithm for determining linear weights, Gaussian centers and wi	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
8	Midterm Exam	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
9	Comparison of parametric and nonparametric methods for data representation. Unsupervised learning as a vector quantiza	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
10	Continuous time Hopfield Network. Stability analysis of multiple equilibrium points of the Hopfield network. Hopfield netwo	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
11	Signal processing applications of artificial neural networks. Principal component analysis. Data compression and reduction.	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
12	Control applications of artificial neural networks.	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
13	Artificial neural network models and sample applications of related learning algorithms	Artificial Neural Networks Lecture Notes	1- Artificial Neural Networks Lecture Not
14	MATLAB Applications	1- Artificial Neural Networks Lecture Not	1- Artificial Neural Networks Lecture Not
15	MATLAB Applications		
16	Final Exam		

Course Learning Outcomes

No	Learning Outcomes
C01	Explains the fundamental concepts and architectures of artificial neural networks.
C02	Identifies and compares different types of artificial neural networks.
C03	Designs, trains, and tests artificial neural networks.
C04	Applies artificial neural networks to data analysis and classification problems.
C05	Evaluates the performance of artificial neural networks and proposes improvement strategies.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	3	42
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	30	30
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	41	41
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	4	4	4	4	4	5	5	3	4	4
C01	4	4	3	4	3	4	4	3	3	4
C02	4	4	4	4	3	4	4	3	3	4
C03	4	5	5	4	4	5	5	3	4	4
C04	4	5	5	4	4	5	5	4	4	4
C05	4	5	5	5	4	5	5	4	4	5

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK537-2024	Electric Energy Economics and Electricity Market				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
2	ELK537-2024	Electric Energy Economics and Electricity Market	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Elective
Objectives of the Course:
The aim of the course is to acquire general economic knowledge, to have knowledge and ideas about the economic processes in the production, transmission, distribution and market operation of electrical energy, and to gain economic design and business skills by using this knowledge.
Teaching Methods and Techniques:
Basic parameters related to general economics and engineering economics/Application of cost accounting to energy systems/Cost and profit calculations/Structure and functioning of the electricity market
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Associate Prof. Dr. Fehmi Aslan
Assistants:

Recommended or Required Reading

Resources

Electricity Market Implementation Handbook, Energy Market Regulatory Authority (EPDK), April 2003.,S. Ay, "Electrical Energy Economics", Birsen Publishing House, 2008
1. S. Ay, "Electrical Energy Economics", Birsen Publishing House, 2008.
2. S. Ay, "Economic Analysis in Engineering", Birsen Publishing House, 2021.
3. S. Ay, "Engineering Economics", Ofis2005, 2018
4. Electricity Market Implementation Handbook, Energy Market Regulatory Authority (EPDK), April 2003

Course Category

Mathmatics and Basic Sciences	:	**Education**	:
Engineering	: 30	**Science**	:
Engineering Design	:	**Health**	:
Social Sciences	: 30	**Field**	: 40

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	General Economic Principles	Review and update course notes	Lecture Notes
2	Introduction to Engineering Economics	Review and update course notes	Lecture Notes
3	Basic Concepts of Engineering Economics	Review and update course notes	Lecture Notes
4	Basic Concepts of Cost Accounting	Review and update course notes	Lecture Notes
5	Basic Concepts of Financial Management	Review and update course notes	Lecture Notes
6	Basic Concepts of General Accounting	Review and update course notes	Lecture Notes
7	Economic Decision Making	Review and update course notes	Lecture Notes
8	Deterministic Methods in Economic Decision Making	Review and update course notes	Lecture Notes
9	Midterm exam	Preparation of exam materials	-
10	Energy Production Costs	Review and update course notes	Lecture Notes
11	Accounting for Energy Production Costs	Review and update course notes	Lecture Notes
12	Accounting for Energy Production Costs	Review and update course notes	Lecture Notes
13	Electricity Market Components and Structure	Review and update course notes	Lecture Notes
14	Electricity Market Operations	Review and update course notes	Lecture Notes
15	Electricity Market Operations	Review and update course notes	Lecture Notes
16	Final exam	Preparation of exam materials	-

Course Learning Outcomes

No	Learning Outcomes
C01	Explains and uses general economic definitions and economic variables of electrical energy systems.
C02	Explains the most economical operating conditions for electrical energy systems.
C03	Calculate the unit production cost (TL/kWh) of various power plants using cost accounting principles.
C04	Explains the components and functioning of the electricity market.
C05	Explains effects different energy modes

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	14	5	70
Hours for off-the-c.r.stud	0	0	0
Assignments	4	25	100
Presentation	0	0	0
Mid-terms	1	25	25
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	30	30
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	2	3	3	4	3	3	2	3	4	3
C01	2	3	3	4	3	3	2	3	4	3
C02	2	3	3	4	3	3	2	3	4	3
C03	2	3	3	4	3	3	2	3	4	3
C04	2	3	3	4	3	3	2	3	4	3
C05	2	3	3	4	3	3	2	3	4	3

Malatya Turgut Özal University

Graduate Education Institute
Electrical and Electronics Engineering (MD with Thesis)

ELK105-2023	Advanced Engineering Mathematics				
Semester	**Course Unit Code**	**Course Unit Title**	**L+P**	**Credit**	**Number of ECTS Credits**
2	ELK105-2023	Advanced Engineering Mathematics	3	3	7,5

Mode of Delivery:
Face to Face
Language of Instruction:
Turkish
Level of Course Unit:
Master's Degree
Work Placement(s):
No
Department / Program:
Electrical and Electronics Engineering (MD with Thesis)
Type of Course Unit:
Required
Objectives of the Course:
The aim of this course is to provide information about advanced mathematical concepts in addition to basic mathematical knowledge in engineering education.
Teaching Methods and Techniques:
Vector differential and integral calculus: Vector algebra, gradient, divergence, curl, curvilinear integral, Green' s theorem in the plane, Divergence theorem, Stokes' theorem. Linear vector spaces: Linear vector space, linear operators, finite dimensional vector spaces, matrix algebra, similarity transformations, eigenvalues and eigenvectors of a matrix. Orthogonal functions: Function spaces, orthogonal polynomials, Legendre polynomials, spherical harmonics, Hermite polynomials, Laguerre polynomials, Bessel functions. Complex Functions: Complex numbers, complex functions, derivatives of complex functions, analytical function concept, Cauchy-Riemann conditions, Complex integral, Cauchy theorem, Cauchy integral formulas, Series expansions of complex functions, Laurent series, Residue theorem and its applications, Multiple functions and Riemann Surfaces . Differential equations: Series method, power series method, Frobenius method, Legendre differential equation, Bessel differential equation, Hermite differential equation, Systems of linear equations
Prerequisites and co-requisities:

Course Coordinator:

Name of Lecturers:
Prof. Dr. Ayhan ESİ
Assistants:

Recommended or Required Reading

Resources

Kreyszig, E. (2011). Advanced engineering mathematics (10th ed.). Wiley.
Karaoğlu, B. (2009). Mathematical methods in physics and engineering.

Vize ve Final Sınavları

Course Category

Mathmatics and Basic Sciences	:	50	**Education**	:	
Engineering	:	40	**Science**	:	
Engineering Design	:	10	**Health**	:	
Social Sciences	:		**Field**	:	

Weekly Detailed Course Contents

Week	Topics	Study Materials	Materials
1	Vector differential and integral calculus: Vector algebra, gradient, divergence, curl, curvilinear integral, Green's theorem in		
2	Divergence theorem, Stokes theorem		
3	Linear vector spaces: Linear vector space, linear operators, finite dimensional vector spaces, matrix algebra		
4	Similarity transformations, eigenvalues and eigenvectors of a matrix		
5	Orthogonal functions: Function spaces, orthogonal polynomials, Legendre polynomials		
6	Spherical harmonics, Hermite polynomials, Laguerre polynomials, Bessel functions		
7	Complex Functions: Complex numbers, complex functions, derivatives of complex functions		
8	Midterm Exam		
9	Analytic function concept, Cauchy-Riemann conditions, Complex integral, Cauchy theorem		
10	Cauchy integral formulas, Series expansions of complex functions, Laurent series		
11	Residue theorem and its applications		
12	Multiple functions and Riemann Surfaces		
13	Differential equations: Series method, power series method		
14	Frobenius method, Legendre differential equation		
15	Frobenius method, Legendre differential equation		
16	Final Exam		

Recommended Optional Programme Components

ELK526-2023 Mathematical Methods in Control Engineering

Course Learning Outcomes

No	Learning Outcomes
C01	Possesses basic and advanced knowledge and understanding of mathematics.
C02	Possesses the ability to think analytically and make evaluations.
C03	Possesses the ability to analyze and evaluate problems that arise in engineering.
C04	Learns advanced vector algebra.
C05	Learns complex analysis.

Program Learning Outcomes

No	Learning Outcome
P01	Research and development departments in the private and/or public sector, Telecommunications, Automotive, Power Plant and Electricity Distribution sectors and the Software sector are the most c
P02	Being able to comprehend the interdisciplinary interaction that Electrical and Electronics Engineering is related to, interpreting the acquired information by integrating it with information from differe
P04	Ability to critically evaluate the expert knowledge and skills acquired in Electrical and Electronics Engineering (Learning Competence).
P05	Ability to systematically convey current developments in Electrical and Electronics Engineering and one's own studies to national or international groups in written, oral and visual form (Communicat
P03	Ability to develop new strategic approaches to solve problems that require expertise related to Electrical-Electronics Engineering, produce solutions by taking responsibility, and take leadership whe
P07	They can effectively apply scientific research methods and data analysis techniques to solve complex engineering problems, and design and conduct original research.
P08	They act in accordance with ethical principles in their field and are aware of social, environmental, and professional responsibilities in research and practice.
P09	They can work effectively in multidisciplinary teams, take active roles in project management processes, and demonstrate leadership skills.
P10	They are aware of the importance of lifelong learning and can continuously follow new technologies, scientific developments, and innovative approaches to sustain their professional development.
P06	They are capable of effectively using and developing current methods, tools, hardware, and software used in the field of Electrical and Electronics Engineering.

Assessment Methods and Criteria

In-Term Studies	Quantity	Percentage
Mid-terms	1	%30
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%70
Total		**%100**

ECTS Allocated Based on Student Workload

Activities	Quantity	Duration	Total Work Load
Course Duration	13	3	39
Hours for off-the-c.r.stud	14	8	112
Assignments	0	0	0
Presentation	0	0	0
Mid-terms	1	35	35
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	39	39
Total Work Load			**225**
ECTS Credit of the Course			**8**

Contribution of Learning Outcomes to Programme Outcomes

bbb

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10
All	5	4	3	4	3	4	3	2	2	4
C01	5	4	3	4	3	4	3	2	2	4
C02	5	5	4	5	3	4	4	3	3	5
C03	5	5	5	5	3	4	5	3	3	5
C04	5	4	3	4	3	4	3	2	2	4
C05	5	4	3	4	3	4	3	2	2	4