ELECTRICAL ELECTRONICS ENGINEERING (English)MSc PROGRAMME

First Year						
I. Semester						
Code	Course Title	ECTS	T+P	Credit	C/E	Language
501001901	THE SCIENTIFIC RESEARCH METHODS AND ITS ETHICS	7.5	3+0+0	3	**C**	English
	Elective Course-1	7.5	3+0+0	3	E	English
	Elective Course-2	7.5	3+0+0	3	E	English
	Elective Course-3	7.5	3+0+0	3	E	English
	Total of I. Semester	30		12		
II. Semester						
Code	Course Title	ECTS	T+P	Credit	C/E	Language
	Elective Course-4	7.5	3+0+0	3	E	English
	Elective Course-5	7.5	3+0+0	3	E	English
	Elective Course-6	7.5	3+0+0	3	E	English
505702001	Seminar	7.5	0+1+0	-	**C**	English
	Total of II. Semester	30		9		
	TOTAL OF FIRST YEAR	60		21		

Second Year						
III. Semester						
Code	Course Title	ECTS	T+P	Credit	C/E	Language
505701702	MSc THESIS STUDY	25	0+1+0	-	**C**	English
505701703	SPECIALIZATION FIELD COURSE	5	3+0+0	-	**C**	English
	Total of III. Semester	30				
IV. Semester						
Code	Course Title	ECTS	T+P	Credit	C/E	Language
505701702	MSc THESIS STUDY	25	0+1+0	-	**C**	English
505701703	SPECIALIZATION FIELD COURSE	5	3+0+0	-	**C**	English
	Total of IV. Semester	30				
	TOTAL OF SECOND YEAR	60				

Elective Courses						
Code	Course Title	ECTS	T+P	Credit	C/E	Language
505702512	ADVANCED DIGITAL SIGNAL PROCESSING	7.5	3+0+0	3	E	English
505701506	Advanced Electromagnetic Theory	7.5	3+0+0	3	E	English
505702502	Advanced Power Electronics	7.5	3+0+0	3	E	English
505702509	Antenna Theory and Design	7.5	3+0+0	3	E	English

505702501	Bezier Curve Modelling	7.5	3+0+0	3	E	English
505702504	DATA COMPRESSION	7.5	3+0+0	3	E	English
505702508	Deep Learning	7.5	3+0+0	3	E	English
505701504	DIGITAL COMMUNICATION USING FPGA	7.5	3+0+0	3	E	English
505701515	DIGITAL SIGNAL PROCESSING	7.5	3+0+0	3	E	English
505701514	Engineering Mathematics	7.5	3+0+0	3	E	English
505702506	GROUNDING AND SHIELDING TECHNIQUES IN INSTRUMENTATION	7.5	3+0+0	3	E	English
505701512	Intelligent Control Systems	7.5	3+0+0	3	E	English
505701501	Introduction to Linear Transformations	7.5	3+0+0	3	E	English
505701502	Introduction To Mobile Robots	7.5	3+0+0	3	E	English
505702510	Learning-Based Control	7.5	3+0+0	3	E	English
505701508	Linear Programming for Engineering Sciences	7.5	3+0+0	3	E	English
505701505	Memory devices and technologies	7.5	3+0+0	3	E	English
505701507	MEMS BASED ACCELEROMETERS and NAVIGATION	7.5	3+0+0	3	E	English
505701510	Microwave Techniques and Applicaitons	7.5	3+0+0	3	E	English
505701516	OPTIMAL POWER SYSTEM OPERATION I	7.5	3+0+0	3	E	English
505702513	OPTIMAL POWER SYSTEM OPERATION II	7.5	3+0+0	3	E	English
505701511	Pattern Recognition Fundamentals	7.5	3+0+0	3	E	English
505701503	Power System Protction I	7.5	3+0+0	3	E	English
505702503	Power System Protction II	7.5	3+0+0	3	E	English
505702505	Semiconductor Device Fabrication and Characterization	7.5	3+0+0	3	E	English
505702507	SEMICONDUCTOR POWER DEVICES	7.5	3+0+0	3	E	English
505701509	SEMICONDUCTOR SOLAR CELLS	7.5	3+0+0	3	E	English
505702514	Sensor Technologies	7.5	3+0+0	3	E	English
505702511	Signal Classification	7.5	3+0+0	3	E	English
505701513	Speech Production and Analysis	7.5	3+0+0	3	E	English

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ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	Joint Course for the Institute	**SEMESTER**	Fall-Spring

COURSE			
CODE	501011901	**TITLE**	The Scientific Research Methods and Its Ethics

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc-Ph.D	3	0	0	3+0	7,5	COMPULSORY (X)	ELECTIVE ( )	Turkish

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
1,5	1,5	

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm	1	40
	Quiz		
	Homework		
	Project		
	Report		
	Seminar		
	Other ( )		
	Final Examination		60

PREREQUISITE(S)	None
SHORT COURSE CONTENT	Science, the scientific thought and other fundamental concepts, the scientific research process and its techniques, Methodology: Data Collecting-Analysis-Interpretation, Reporting the scientific research (Preparation of a thesis, oral presentation, article, project), Ethics, Ethics of scientific research and publication.
COURSE OBJECTIVES	The main objectives are: To examine the foundations of scientific research and the scientific research methods, to teach the principles of both the methodology and the ethics, to realize the process on a scientific research and to evaluate the results of research, to teach reporting the results of research (on a thesis, presentation, article).
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Applying the scientific research methods and the ethical rules in their professional life.
LEARNING OUTCOMES OF THE COURSE	Gaining awareness on ethical principles at basic research methods, becoming skillful at analyzing and reporting the data obtained in scientific researches, being able to have researcher qualification with occupational sense of responsibility, having the scientific and vocational ethics' understanding and being able to defend this understanding in every medium.
TEXTBOOK (Turkish)	Karasar, N. (2015). Bilimsel Araştırma Yöntemi. Nobel Akademi Yayıncılık, Ankara.

OTHER REFERENCES	**1-**Büyüköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., Karadeniz, Ş., Demirel, F. (2012). Bilimsel Araştırma Yöntemleri. Pegem Akademi Yayınevi, Ankara. **2-**Tanrıöğen, A. (Editör). (2014). Bilimsel Araştırma Yöntemleri. Anı Yayıncılık, Ankara. **3-**Türkiye Bilimler Akademisi Bilim Etiği Komitesi. Bilimsel Araştırmada Etik ve Sorunları, Ankara: TÜBA Yayınları, (2002). **4-**Ekiz, D. (2009). Bilimsel Araştırma Yöntemleri: Yaklaşım, Yöntem ve Teknikler. Anı Yayıncılık, Ankara. **5-**Day, Robert A. (Çeviri: G. Aşkay Altay). (1996). Bilimsel Makale Nasıl Yazılır ve Nasıl Yayımlanır?, TÜBİTAK Yayınları, Ankara. **6-**Özdamar, K. (2003). Modern Bilimsel Araştırma Yöntemleri. Kaan Kitabevi, Eskişehir. **7-**Cebeci, S. (1997). Bilimsel Araştırma ve Yazma Teknikleri. Alfa Basım Yayım Dağıtım, İstanbul. **8-**Wilson, E. B. (1990). An Introduction to Scientific Research. Dover Pub. Inc., New York. **9-**Çömlekçi, N. (2001). Bilimsel Araştırma Yöntemi ve İstatistiksel Anlamlılık Sınamaları. Bilim Teknik Kitabevi, Eskişehir.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Science, scientific thought and other basic concepts (University, history of university, higher education, science, scientific thought and other related concepts)
2	Science, scientific thought and other basic concepts (University, history of university, higher education, science, scientific thought and other related concepts)
3	The scientific research and its types (Importance of the scientific research, types of science, scientific approach)
4	The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning)
5	The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning)
6	The scientific research process and its techniques (Access to the scientific knowledge, literature search, determining the research issue, definition of the problem, planning)
7	The method and the approach: Collecting, analysis and interpretation of the data (Data, data types, measurement and measurement tools, collecting data, organizing data, summarizing data, analysis and the interpretation of data)
8	The method and the approach: Collecting, analysis and interpretation of the data (Data, data types, measurement and measurement tools, collecting data, organizing data, summarizing data, analysis and the interpretation of data)
9	Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project)
10	Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project)
11	Finalizing the scientific research (Reporting, preparing the thesis, oral presentation, preparing an article and a project)
12	Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors)
13	Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors)
14	Ethics, scientific research and publication ethics (Ethics, rules of ethics, occupational ethics, non-ethical behaviors)
15,16	Mid-term exam, Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INSTITUTE'S GRADUATE PROGRAMME'S LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (M.Sc.-Ph.D.)**	**3** High	**2** Mid	**1** Low
LO 1	Having the scientific and vocational ethics' understanding and being able to defend this understanding in every medium.	☒	☐	☐
LO 2	Being able to have researcher qualification with occupational sense of responsibility.	☒	☐	☐
LO 3	Becoming skillful at analyzing and reporting the data obtained in scientific researches.	☒	☐	☐
LO 4	Gaining awareness on ethical principles at basic research methods.	☒	☐	☐

Prepared by : **Date:**

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Spring

COURSE			
CODE		TITLE	Advanced Power Electronics

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
	0	

ASSESSMENT CRITERIA

	Evaluation Type	Number	Contribution (%)
SEMESTER ACTIVITIES	Midterm	1	30
	Quiz		
	Homework		
	Project		
	Report	1	15
	Seminar		
	Other (……)		
	Final Examination		55

PREREQUISITE(S)	-
SHORT COURSE CONTENT	In this course, semiconductor elements such as diodes ,GTO,IGBT,MOSFET and transistors will be reviewed.Linear regulator elements and circuits built with these elements are examined.switching mode power supplies and converters(Flyback,Forward converters,Resonant converters,…) are studied and analyzed.modern speed control devices are designed and examined.Soft and hard switching methods , snuber and protection circuits will be rewiewed.
COURSE OBJECTIVES	The aim of this course is the investigate of circuit topologies in high power electronics applications and to learn the design of modern Ac, Dc speed control devices used in industry.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	knowledge in power electronics, transient circuit analysis technique, modeling and digital simulation technique. ability to read and criticize articles
LEARNING OUTCOMES OF THE COURSE	learn the current changes in the field of power electronics and the basic concepts that constitute the infrastructure of these changes.
TEXTBOOK	ower Electronics circuit,Devices and applications,Muhammad H.Rashid,prentic- Hall
OTHER REFERENCES	power electronics:converters,Applicatios,and design;N.Mohan,Tore undeland,William P

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Commutation techniques
2	Natural and forced commutation
3	Overview of rectifiers,effect of source inductance in rectifier circuit
4	Flyback,Forward converters
5	Push pull,Cuk converters
6	Midterm Examination
7	Resonant converters(series,parallel,series parallel)
8	Resonant converters(series,parallel,series parallel)
9	Cyclo converters
10	Three phase inverter,PWM,THD,Harmonic elimination methods
11	Soft and hard switching methods
12	Semiconductor device protection,Thermal consideration
13	Semiconductor device protection,Thermal consideration
14	snuber and protection circuits
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☒	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☒	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Assis.prof.Dr Atabak NAJAFİ **Date:** 27.01.2022

Signature:

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ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	DESIGN OF ELECTRICAL MACHINES

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
	0	

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm	1	20
	Quiz		
	Homework		
	Project	1	15
	Report		
	Seminar	1	15
	Other (……)		
	Final Examination		50

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Transformer design-DC machines design-Induction machined design-Computer aided design of electrical machines
COURSE OBJECTIVES	Designing of different types of electrical machines .
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	-Students who have taken this course and who have succeeded in this course have enough knowledge about designing ,heating and cooling of electrical machines
LEARNING OUTCOMES OF THE COURSE	- student learn the general information about the concepts and limits of machine design -Knows basic information about transformer design - Knows basic knowledge about the design of direct current machines -Knows basic knowledge about induction motor design -Knows the basic knowledge about the design of permanent magnet motors
TEXTBOOK	1-Electrical Machine Design', Balbir Singh, Brite Publications, Pune.

OTHER REFERENCES	1-A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age Intenational Pvt. Ltd., Reprint 2007. 2-The Design And Specification Of Direct And Alternating Current Machinery, Alexander Gray, Gray Pres, 2007.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Electrical Engineering Materials
2	Heating and cooling of electric machines
3	General concepts and limits of machine design.
4	Transformer design
5	Transformer design
6	Midterm Examination
7	Design of direct current (DC) machines
8	Design of direct current (DC) machines
9	Induction motor design
10	Induction motor design
11	Permanent magnet motors
12	Permanent magnet motors
13	Computer aided design of electrical machines
14	Computer aided design of electrical machines
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☒	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☒	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Assis.Prof.Dr.Atabak NAJAFİ

Date: 27.01.2022

Signature:

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ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Spring

COURSE			
CODE		**TITLE**	Antenna Theory and Design

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm		
	Quiz		
	Homework		65
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		35

PREREQUISITE(S)	None
SHORT COURSE CONTENT	General antenna parameters, dipole and loop antennas, radiation integrals and vector potentials, antenna arrays, antenna synthesis, patch antennas, aperture antennas, horn antennas
COURSE OBJECTIVES	1-Learn about the basic of radiation 2-Learn different antenna types an their characteristics 3-Learn the design and analysis of antenna arrays 4-Learn antenna synthesis
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Learn the theory and practical antenna aspects that is widely used in defense sector
LEARNING OUTCOMES OF THE COURSE	1-Learn about the basic of radiation 2-Learn different antenna types an their characteristics 3-Learn the design and analysis of antenna arrays 4-Learn antenna synthesis
TEXTBOOK	Constantin Balanis, Antenna Theory: Analysis and Design," 4th Edition, Wiley, 2016
OTHER REFERENCES	-

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Electromagnetic Theory: Wave equations and plane wave solutions,
2	Antenna parameters: Radiation pattern and density, directivity, gain and efficiency
3	Antenna parameters: Bandwidth, Impedance, Radiation efficiency, Friis and radar equations
4	Radiation integrals and vector potentials: Vector potentials, far-field equations
5	Dipol antenna: Infinitesimal, small half wavelength dipole antennas, ground plane effects
6	Loop antenna: Small Lopp antenna, ground plane effects
7	Patch Antennas: Rectangular and circular antennas, quality, bandwidth, efficiency, coupling
8	Aperture Antennas: Hygens principle, Radition equations, rectangular aperture, Babinets principle
9	Horn Antennas: E-Plane and H-Plane horn antennas, Corrugated horn antennas
10	Antenna Arrays: Equal spacing equal amplitude arrays
11	Antenna Arrays: Equal spacing unequal amplitude arrays
12	Antenna Arrays: 2D planar arrays
13	Antenna Synthesis: Schelkunoff Polynomial method
14	Antenna Synthesis: Fourier Transform method
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☒	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☒	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Asst. Prof. Hayrettin Odabaşı **Date:** 28/03/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	Microwave Techniques and Applicaitons

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm		25
	Quiz		
	Homework		40
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		35

PREREQUISITE(S)	None
SHORT COURSE CONTENT	Summary of electromagnetic theory. Transmission line theory. Transmission Lines and Waveguides. Impedance matching. Microwave Network Analysis. Microwave Resonators. Power Dividers and Directional Couplers. Microwave Filters. Noise. Microwave Amplifiers. Oscilators and Mixers. Microwave Systems.
COURSE OBJECTIVES	Understand the bascis of microwave theory and techniques. Be able to use these techniques in problems involving microwave components and systems.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Students will have a basic understanding of microwave engineering. They will be able to solve real life microwave engineering problems with tecniques and subjects they will learn throughout the course.
LEARNING OUTCOMES OF THE COURSE	-Get to know the electromagnetic theory -Learn the transmission line theory -Learn how to analyze transmission lines and other microwave components -Learn commonly used microwave components
TEXTBOOK	David M. Pozar, "Microwave Engineering," 4th Edition, Wiley
OTHER REFERENCES	-

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Electromagnetic theory: Wave Equation Solutions, Reflection and Transmission of EM waves
2	Waveguides and Transmission Lines: TE, TM and TEM Solutions, Parallel Plate Waveguide, Rectangular Waveguides, Micrtostrip, Striplines
3	Transmission Line Theory: Lumped Element Model, Lossless Transmission Lines
4	Transmission Line Theory: Terminated Transmission Lines
5	Transmission Line Theory: Quarter Wave Transformer, Generator and Load Mismatch
6	Transmission Line Theory: The Smith Chart
7	Transmission Line Theory: The Smith Chart
8	Impedance Matching: Lumped Element Matching
9	Impedance Matching: Single Stub Tuning, Double Stub Tuning
10	Microwave Networks: Z Matrix, S Matrix, and ABDC Matrix Analysis
11	Microwave Networks: Z Matrix, S Matrix, and ABDC Matrix Analysis
12	Power Dividers and Driectional Couplers: Dividers and Couplers
13	Power Dividers and Driectional Couplers: T-Junction Power Divider, Wilkinson Power Divider,
14	Power Dividers and Driectional Couplers: Quadrature Couplres, Coupled Line directional Couplers
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☒	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☒	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Asst. Prof. Hayrettin Odabaşı

Date: 28/03/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING (MSc)	SEMESTER	Spring

COURSE			
CODE		TITLE	DATA COMPRESSION

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3			3	7.5	COMPULSORY ( )	ELECTIVE (x)	ENGLISH

CREDIT DISTRIBUTION

Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
1		2

ASSESSMENT CRITERIA

	Evaluation Type	Number	Contribution (%)
SEMESTER ACTIVITIES	Midterm		
	Quiz		
	Homework	2	60
	Project		
	Report		
	Seminar		
	Other ( )		
	Final Examination		40

PREREQUISITE(S)	
SHORT COURSE CONTENT	Information theory and data compression methods
COURSE OBJECTIVES	Students' view of information, data and coding concepts will be enhanced. Popular data compression methods will be taught.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Will contribute to the knowledge base of students on common data compression techniques.
LEARNING OUTCOMES OF THE COURSE	Students will; 1. Gain a new view on information and data concepts 2. Get familiar with the common data compression algorithms 3. Gain capability to chooes from various methods where coding is necessary 4. Evaluate purpose of coding blocks in a system and develop alternative ideas 5. Develop simple coding algorithms and apply them on data
TEXTBOOK	K. Sayood, Introduction to Data Compression 5th ed., Morgan Kaufmann, 2018

OTHER REFERENCES	D.J.C. MacKay, Information Theory, Inference, and Learning Algorithms, Cambridge, 2003 I.M. Pu, Fundamental Data Compression, Butterworth-Heinemann, 2006

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction to Information Theory
2	Introduction to Information Theory, Entropy
3	Shannon-Fano Coding
4	Huffman Coding
5	Arithmetic Coding
6	An Overview on Dictionary Methods
7	Lossless Image Compression
8	Differential Coding
9	Vector Quantization
10	Transform Coding
11	Transform Coding cont'd
12	Video Coding
13	Video Coding cont'd
14	Video Coding cont'd
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc PROGRAM LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by : Erol SEKE **Date:** 20.5.2021

Signature:

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ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Spring

COURSE			
CODE		**TITLE**	ADVANCED DIGITAL SIGNAL PROCESSING

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm	1	30
	Quiz		
	Homework	2	20
	Project		
	Report		
	Seminar	1	10
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	Sayısal İşaret İşleme, Digital Signal Processing
SHORT COURSE CONTENT	Digital Signal Processing-Review, Hilber Transform, Multirate Digital Signal Processing, Linear Prediction and Optimum Linear Prediction Filters, Adaptive Filters, Power Spectrum Estimation, Cepstrum Analysis and Homomorphic Deconvolution
COURSE OBJECTIVES	The aim of the course is to teach theory and applications of advanced DSP techniques
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Knowledge on theory of advaced digital signal processing techniques and their applications
LEARNING OUTCOMES OF THE COURSE	Knows theory of the following advanced digital signal processing techniques and their applications: -Hilber Transform -Multirate Digital Signal Processing -Linear Prediction and Optimum Linear Prediction Filters -Adaptive Filters -Power Spectrum Estimation -Cepstrum Analysis and Homomorphic Deconvolution

TEXTBOOK	J. G. Proakis, D. G. Manolakis: Digital Signal Processing: Principles, Algorithms, and Applications, Prentice Hall, S. K. Mitra: Digital Signal Processing: A Computer-Based Approach, McGraw Hill Higher Education, 2000 A. V. Oppenheim, R. W. Schafer: Discrete-time signal processing, Prentice Hall, 1999, 2nd edition
OTHER REFERENCES	

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Fundamentals of Digital Signal Processing
2	Hilbert Transform
3	Multirate Digital Signal Processing
4	Application of Multirate Signal Processing
5	Digital Filter Bank
6	Linear Prediction
7	Optimum Linear Prediction Filters
8	MIDTERM
9	Adaptive Filters
10	Direct Form Adaptive and Lattice Filters
11	Power Spectrum Estimation
12	Power Spectrum Estimation
13	Cepstrum Analysis and Homomorphic Deconvolution
14	Cepstrum Analysis and Homomorphic Deconvolution
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☐	☒
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☒
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☒	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Prof.Dr. Rifat EDİZKAN **Date:** 17/04/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	DIGITAL SIGNAL PROCESSING

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm	1	30
	Quiz		
	Homework	2	20
	Project		
	Report		
	Seminar	1	10
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Discrete time signals and systems, z-transform and LTI system analysis, Frequency analysis of signals, Frequency domain analysis of LTI systems, sampling, discrete Fourier transform (DFT) and FFT, discrete system implementations, filter design
COURSE OBJECTIVES	The aim is to teach the principles of the digital signal processing
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Knowledge on use and design of digital signal processing system in applications
LEARNING OUTCOMES OF THE COURSE	-Knows the properties of discrete time signals and systems -Can analyse LTI systems analysis using z-transforms -Learn the frequency domain properteis of LTI systems -Knows the processing of the continuous system with discrete systems -Recognize A/D and D/A converters -Knows how to analyze frequency properties of signals using DFT and FFT -Learns the implementaions of the discrete systems -Knows digital filter design methods

TEXTBOOK	A.V. Oppenheim and R.W. Schafer, Discrete-Time Signal Processing, Prentice-Hall, Inc., 1999 J.G.Proakis, D.G. Manolakis, "Digital Signal Processing", 4th Ed., Pearson International Edition, Upper Saddle River, NJ 07458, 2007. ISBN 9780131873741.
OTHER REFERENCES	

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Discrete-Time Signals and Sistems
2	Discrete-Time Signals and Sistems
3	Z-Transform And Its Application To The Analysis Of LTI Systems
4	Frequency Analysis of Signals
5	Frequency Domain Analysis of LTI Systems
6	Sampling and Reconstruction of Signals
7	Changing Sampling Rate Using Discrete Time Process
8	MIDTERM
9	Processing of Continuous Time Signal Using Discrete-Time Systems, A/D and D/A Converters
10	Discrete Fourier Transform: Its Properties and Applications, Fast Fourier Transform
11	Imlementation of Discrete-Time Systems
12	Filter Digital Techniques-FIR Filters
13	Filter Design Techniques-IIR Filters
14	Fourier Analysis of Signals Using Discrete Fourier Transform
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☐	☒
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☒	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Prof.Dr. Rifat EDİZKAN **Date:** 17/04/2022

Signature:

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ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING (MSc)	SEMESTER	Fall

COURSE			
CODE		TITLE	DIGITAL COMMUNICATION USING FPGA

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3			3	7.5	COMPULSORY ( )	ELECTIVE (x)	ENGLISH

CREDIT DISTRIBUTION

Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
		3 √

ASSESSMENT CRITERIA

	Evaluation Type	Number	Contribution (%)
SEMESTER ACTIVITIES	Midterm		
	Quiz		
	Homework		
	Project	2	60
	Report		
	Seminar		
	Other ( )		
	Final Examination		40

PREREQUISITE(S)	Undergraduate courses: Digital Systems, Communications (in addition, students need to obtain hardware required for implementations; FPGA board, computer, design software).
SHORT COURSE CONTENT	Basic components of digital communication systems will be designed using VHDL and implemented on FPGA; signal generation, modulation, error control.
COURSE OBJECTIVES	Build design experience on VHDL and FPGA
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Contributes to experience on modern digital design.
LEARNING OUTCOMES OF THE COURSE	Students will; 1. Reinforce their knowledge on modern communication systems 2. Design system components and implement them 3. Analyze the components that they design 4. Evaluate the performances of the components and improve them
TEXTBOOK	E. Seke, VHDL Örnekleriyle Sayısal Haberleşmeye Giriş, Seçkin Yayıncılık, 2017
OTHER REFERENCES	V.A. Pedroni, Circuit Design with VHDL, MIT Press

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Basic digital components and introduction to synthesizer software
2	Basic digital components and introduction to synthesizer software, examples cont'd
3	Basic signal generation and monitoring on oscilloscope
4	Complex signal generation and communication with ADC/DAC, generation of noise signal
5	Complex signal generation and communication with ADC/DAC, sinusoidal signal examples cont'd
6	Tranceiving through loop-back
7	Integrator receiver, symbol duration integration and integrate-dump
8	Correlator receiver, decision circuit
9	Symbol synchronization on signal reception
10	Frame synchronization
11	FIFO, duplex flow control
12	Digital design of modulation circuit, BPSK
13	Design of a general quadrature modulator circuit
14	Parity bits, error control codes
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc PROGRAM LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☒	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by : Erol SEKE **Date:** 20.5.2021

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	OPTIMAL POWER SYSTEM OPERATION I

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
		3

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm	2	60
	Quiz		
	Homework		
	Project		
	Report		
	Seminar		
	Other (……)		
		Final Examination	40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Introduction, Characteristics of power generation units, Economic dispatch of thermal units and methods of solutions, Transmission losses, Unit commitment, Generation with limited energy supply.
COURSE OBJECTIVES	To explain the problem of economic operation of electric power system and solution methods to this problem.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Providing basics for the engineers to take part in the operation of power systems
LEARNING OUTCOMES OF THE COURSE	An ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. Ability to determine, define, formulate and solve complex engineering problems. Ability to select and use convenient analytical and experimental methods.
TEXTBOOK	Power Generation Operation & Control, Allen J. Wood, Bruce F. Wollenberg, John Wiley & Sons, 1996□
OTHER REFERENCES	

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction, Importance of optimal power distribution
2	Characteristics of power generation units
3	Economic dispatch of thermal units
4	Classical solution methods
5	Power flow problem
6	Transmission losses, penalty factors
7	Optimal unit determination, spinning reserve
8	Prioritizing
9	Unit commitment
10	Generation with limited energy supply
11	Take or Pay Contract
12	Solution methods
13	Solution methods
14	Solution methods
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☒	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☒	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Prof. Dr. Salih FADIL **Date:** 25.03.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Spring

COURSE			
CODE		TITLE	OPTIMAL POWER SYSTEM OPERATION II

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
		3

ASSESSMENT CRITERIA

	Evaluation Type	Number	Contribution (%)
SEMESTER ACTIVITIES	Midterm	2	60
	Quiz		
	Homework		
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Hydrothermal coordination problem, Generation control, Energy transactions and power pools, Electric power system security
COURSE OBJECTIVES	Engineers working in the field of power system operation learn some fundamental subjects of economic power system operation.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Some fundamental subject in the field of economic power system operation is given in this course
LEARNING OUTCOMES OF THE COURSE	An ability to apply theoretical and practical knowledge on solving and modeling of engineering problems. Ability to determine, define, formulate and solve complex engineering problems. Ability to select and use convenient analytical and experimental methods.
TEXTBOOK	Power Generation Operation & Control, Allen J. Wood, Bruce F. Wollenberg, John Wiley & Sons, 1996
OTHER REFERENCES	Optimal Economic Operation of Electric Power SystemEl-Hawary, M. E, Chiristensen G. S.Academic, New York, 1979

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Hydrothermal coordination problem, Introduction, Long-range hydro scheduling, Short-range hydro scheduling, Hydroelectric plant model, Scheduling of energy, Example problem solution
2	The short-term hydrothermal scheduling problem modeling, Solution via lambda-gamma iteration method, Example problem solution
3	Short-term hydro scheduling via gradient approach, Hydro units in series (hydraulically coupled), example problem solution
4	Pumped-storage hydro plants, Pumped-storage hydro scheduling with lambda-gamma iteration method
5	Pumped-storage hydro plants, Pumped-storage hydro scheduling by a gradient method
6	Pumped-storage hydro scheduling, Example problem solution
7	Control of generation, Generator model, Load model, Prime-mover model, Governor model
8	Tie-line model, Example problem solution, Generation control, Supplementary control action, Tie-line control, Generation allocation
9	Automatic generation control (AGC) implementation, AGC features, Example problem solution
10	Power system security, Introduction, Factors affecting power system security, Contingency analysis-detection of network problems,
11	An overview of security analysis, Linear sensitivity factors
12	Example problem solution, AC power flow methods, Calculation of linear sensitivity factors
13	Interchange of power and energy, Economy interchange between interconnected utilities, Interutility economy energy evaluation, Power pools and other type of interchanges, Example problem solution
14	Interchange of power and energy, Economy interchange between interconnected utilities, Interutility economy energy evaluation, Power pools and other type of interchanges, Example problem solution
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☒	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☒	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Prof. Dr. Salih FADIL **Date:** 25.03.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Spring

COURSE			
CODE		TITLE	Deep Learning

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
	3	

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	Evaluation Type	Number	Contribution (%)
	Midterm	1	20
	Quiz		
	Homework	4	30
	Project	1	20
	Report		
	Seminar		
	Other (……)		
	Final Examination		30
PREREQUISITE(S)	Linear Algebra, Probability		
SHORT COURSE CONTENT	Fundamentals of deep learning, Design and training of deep neural networks, Convolutional neural networks, Recurrent neural networks, Autoencoders, Recent developments in deep learning		
COURSE OBJECTIVES	- Learn basics of deep learning methods - Learn convolutional neural networks, recurrent neural networks, autoencoders - Learn and apply basiscs of network design, learn to appropriately train deep neural networks - Develop a deep-learning based approach towards the solution of a machine learning problem		
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Students will learn basic principles of deep learning methods, which are widely used in machine learning applications. Students will understand basic considerations for the design and training of deep learning architectures for machine learning problems.		

LEARNING OUTCOMES OF THE COURSE	To provide the students - Basic principles of deep learning - Familiarization with fundamental building blocks of deep neural networks - Knowledge of various deep network architectures - Understanding of basic considerations in the design and training of deep neural networks
TEXTBOOK	I. Goodfellow, Y. Bengio, A. Courville, Deep Learning, MIT Press, 2016.
OTHER REFERENCES	Hands-On Machine Learning with Scikit-Learn and TensorFlow, O'Reilly Media, By Aurélien Géron (2017) K. P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction, Machine learning basics, Performance measures
2	Supervised and Unsupervised machine learning techniques, Overfitting and underfitting, Regularization, Hyperparameters, Validation Sets
3	Stochastic gradient descent, Back-propagation
4	Deep feedforward neural networks, Gradient-based learning, Cost functions
5	Deep feedforward neural networks, Activation functions, Architectural design considerations, Initialization, Back-propagation considerations
6	Regularization for deep learning, Data augmentation, Batch normalization, Dropout
7	Convolutional neural networks, The convolution operation, Pooling, Architectures, Data types
8	Sequence modeling, Encoder-Decoder sequence to sequence architectures
9	Sequence modeling, Recurrent Neural Networks (RNN), The Long Short-Term Memory and Other Gated RNNs
10	Attention and memory, Self-attention, Transformer networks
11	Autoencoders
12	Generative adversarial networks
13	Project presentations and discussion
14	Project presentations and discussion
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☒	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Helin Dutağacı **Date:**

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Spring

COURSE			
CODE		**TITLE**	Advanced Image Processing

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm	1	25
	Quiz		
	Homework	1	20
	Project	1	15
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Digitizing images; point, algebraic and geometric operations; Fourier transform and discrete image transforms; image enhancement; image segmentation; image restoration; visual object classification/detection; image retrieval, viual object tracking.
COURSE OBJECTIVES	Aim of this course is to teach the major topics of digital image processing beginning with the basic mathematical tools needed for the subject.Ability to choose and apply the necessary tools and methods to solve the problems in engineering applications related to the computer vision.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Ability to choose and apply the necessary tools and methods to solve the problems in engineering applications related to the computer vision.
LEARNING OUTCOMES OF THE COURSE	Students learn basic concepts and methods in digital image processing field. They cn learn how to code image processing methods. The students can apply these methods in commercial and endustrial applications that involve computer vision.
TEXTBOOK	1) R. C. Gonzalez and R. E. Woods, Digital Image Processing, Prentice Hall; 3rd edition (August 31, 2007).

OTHER REFERENCES	1) K. R. Castleman, Digital Image Processing, Prentice Hall; 2nd edition (September 2, 1995).2) A. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall; US Ed edition (October 3, 1988).

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Digitizing Images
2	Gray-Level Histogram
3	Point, Algebraic, and Geometric Operations
4	Linear Systems Theory
5	Fourier Transform and Discrete Image Transforms
6	Image Enhancement
7	Image Restoration
8	Image Segmentation
9	Midterm Examination 1
10	Visual Object Classification
11	Visual Object Detection
12	Image Retrieval
13	Large Scale Image Retrieval
14	Visual Object Tracking
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☒	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☒	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☒	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Prof. Dr. Hakan Çevikalp **Date:** 24/3/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Spring

COURSE							
CODE		**TITLE**	Bezier Curve Modelling				
LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**	**LANGUAGE**
	Theory	**Practice**	**Laboratory**				
MSc	3	0	0	3	7,5	COMPULSORY ( ) / ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
√)		

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm	1	40
	Quiz		
	Homework		
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		60

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Affine independence, affine basis, affine space dimension, affine transformation, affine space, Chasles's identity, Barycenter, affine maps, Neville's algorithm, de Casteljau's algorithm, Bezier curves, control points, Combining Bezier curves, Applications in computyer graphics
COURSE OBJECTIVES	Understanding data interpolation in computer graphics
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	A background in the computer graphics
LEARNING OUTCOMES OF THE COURSE	A proficiency in using data interpolation tools
TEXTBOOK	R. Goldman, Pyramid Algorithms, The Morgan Kaufmann Series in Computer Graphics and Geometric Modeling, 2003
OTHER REFERENCES	--

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Affine idependence, affine basis, affine dimension
2	Affine transformation
3	Affine space
4	Chasles's identity
5	Barycenters
6	Affine maps
7	Linear interpolation
8	Neville's algorithm
9	de Casteljau's algorithm
10	Bezier curves
11	Curves and control points
12	Elementary properties of Bezier curves
13	Combining Bezier Curves
14	Applications in computer graphics
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Abdurrahman Karamancıoğlu **Date:** 14.01.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Spring

COURSE			
CODE		**TITLE**	GROUNDING AND SHIELDING TECHNIQUES IN INSTRUMENTATION

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
1	1	1 √

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm	1	30
	Quiz		
	Homework	1	30
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	The general shielding and grounding processes will be described. Capacitive and magnetic coupling effects at source and transmission are described
COURSE OBJECTIVES	Gaining the ability of EMI-EMC friendly electronic design practices
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Having the knowledge of design practices towards EMI-EMC standards. Having knowledge about the general noise reduction techniques in electronic circuits and wired transmission practices
LEARNING OUTCOMES OF THE COURSE	LO1, LO2, LO8, LO9
TEXTBOOK	Grounding and Shielding Techniques in Instrumentation, Ralph MORRISON
OTHER REFERENCES	Noise Reduction Techniques in Electronic Systems, Henry W. Ott

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Electrostatics
2	Capacitance and Energy Storage
3	Applying Electrostatics to Practical Processes
4	Practical Shielding in Instruments
5	Differential Amplifier
6	General Application Problems
7	Shielding in Resistance-Bridge Systems
8	Magnetic Processes in Instrumentation
9	RF Processes in Insrumentation
10	Earth Plane
11	Cabling
12	Grounding
13	PCB design Issues
14	EMI-EMC Regulation
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☒	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☒	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☒	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☒	☐

Prepared by: GD **Date:**

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	Introduction to Linear Transformations

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
√)		

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm	1	40
	Quiz		
	Homework		
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		60

PREREQUISITE(S)	None-
SHORT COURSE CONTENT	Vector Spaces, Complex Numbers, Definition of Vector Space, Properties of Vector Spaces, Subspaces, Sums and Direct Sums, Finite-Dimensional Vector Spaces, Span and Linear Independence, Bases, Dimension, Linear Maps, Null Spaces and Ranges, The Matrix of a Linear Map, Invertibility, Polynomials, Complex Coefficients, Real Coefficients, Eigenvalues and Eigenvectors, Invariant Subspaces, Polynomials Applied to Operators, Upper-Triangular Matrices, Diagonal Matrices, Invariant Subspaces on Real Vector Spaces,
COURSE OBJECTIVES	Concept of multivariable linearity
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	A background for understanding technical material
LEARNING OUTCOMES OF THE COURSE	Proficiency in matrix algebra
TEXTBOOK	S. Axler, Linear Algebra Done Right, Springer, 1997
OTHER REFERENCES	

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Vector Spaces, Complex Numbers, Definition of Vector Space
2	Properties of Vector Spaces, Subspaces, Sums and Direct Sums
3	Finite-Dimensional Vector Spaces
4	Span and Linear Independence, Bases,
5	Dimension, Linear Maps,
6	Null Spaces and Ranges, The Matrix of a Linear Map,
7	Invertibility, Polynomials,
8	Complex Coefficients, Real Coefficients,
9	Eigenvalues and Eigenvectors, Invariant Subspaces,
10	Polynomials Applied to Operators,
11	Upper-Triangular Matrices
12	Diagonal Matrices,
13	Invariant Subspaces on Real Vector Spaces,
14	Invariant Subspaces on Real Vector Spaces,
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Abdurrahman Karamancıoğlu **Date:** 14.01.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Fall

COURSE			
CODE		TITLE	Linear Programming for Engineering Sciences

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	Evaluation Type	Number	Contribution (%)
	Midterm	1	20
	Quiz		
	Homework	1	20
	Project	1	20
	Report		
	Seminar		
	Other (……)		
		Final Examination	40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Simplex method; Revised Simplex methpd; Duality theorem; Sensitivity analysis; Interior point methods; Integer programming.
COURSE OBJECTIVES	Aim of this course is to teach the major topics of linear programming methods with the basic mathematical tools needed for the subject. A simple introduction to convex analysis will be given as well.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Ability to choose and apply the necessary tools and methods to solve the problems in engineering applications related to the linear programming.
LEARNING OUTCOMES OF THE COURSE	1) Students learn basic topics of linear programming 2) Students learn how to implement Simplex Method 3) Students learn how the linear programming methods can be applied to solve real-world problems.
TEXTBOOK	V. Chvatal, Linear Programming, W. H. Freeman and Company, 16th Printing, 2002.
OTHER REFERENCES	R. J. Vanderbei, Linear Programming: Foundations and Extensions, Springer, 3rd edition, 2007

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction to simplex method
2	Pitfalls and how to avoid them
3	Duality Theorem
4	Implementation issues
5	Revised simplex method
6	General LP Problems: Solutions by the Simplex Method
7	General LP Problems: Theorems on Duality and Infeasibility
8	Sensitivity Analysis
9	Midterm Examination 1
10	Application of LP on Selected Applications
11	Interior points method
12	Integer programming
13	Integer programming
14	Review
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☒	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☒	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Prof. Dr. Hakan Çevikalp **Date:** 24/3/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	MEMS BASED ACCELEROMETERS and NAVIGATION

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
0	3	0 √

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm	1	30
	Quiz		
	Homework	1	30
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	MEMS based linear and angular acceleration devices will be taken to the account. Their working principles, dynamics and signalization types will be analysed. Furthermore their usage in navigation systems will be investigated. The problems and error correcting methods will be discussed.
COURSE OBJECTIVES	MEMS devices are used in defense, transportation, industrial equipments and many other industries as well as they are used in the entertainment equipments. Their dropping prices make them innovatively used in many new fields. The purpose of this course is to give a sufficient scientific background to the students want to work in these mentioned areas.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	The students completed this course succesfully shoul have the sufficient knowledge of the efficient useage of MEMS devices.
LEARNING OUTCOMES OF THE COURSE	LO1, LO2, LO4, LO5
TEXTBOOK	Principles of GNSS, Inertial, and Multisensor Integrated Navigation Systems, Paul D. Groves

OTHER REFERENCES	An Introduction to Micromechanical System Engineering, secon ed. Nadim Maluf,Kirt Williams MEMS and Microstructures in Aerospace Applications, Robert Osiander, M.Ann Garrison Darrin, John L. Champion

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction
2	Navigation Mathematics
3	The Kalman Filter
4	Inertial Sensors, Accelerometers
5	Inertial Sensors, Gyroscopes
6	Inertial Navigation, inertial-frame equations
7	Inertial Navigation, earth-frame equations
8	Inertial Navigation, local-frame equations
9	Navigation Equations Precision
10	Dead Reckoning, Attitude, and Height Measurement
11	Feature Matching
12	Multisensor Integrated Navigation
13	MPU6050
14	Processing of MPU6050 Data
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☐	☒
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☒
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: GD **Date:**

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE	503101512	**TITLE**	Memory devices and technologies

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm		
	Quiz	3	30
	Homework	3	30
	Project		
	Report		
	Seminar		
	Other (……)		
		Final Examination	40

PREREQUISITE(S)	Introductory level solid state physics and semiconductor devices
SHORT COURSE CONTENT	Electrical properties of materials, principles of semiconductor devices, Junctions, Field ffect transistors, bipolar junction transistors, fabrication processes (deposition, implantation, lithography, etching), Current and emerging solid-state memory device technologies including DRAM, SRAM, flash memory, ferroelectric memory, magnetoresistive memory, phase-change memory and resistive memory, with an emphasis on the underlying physical mechanisms.
COURSE OBJECTIVES	Having an introductory knowledge on solid state physics, semiconductor devices, novel materials and devices, understanding the fabrication processes. Understanding the physical mechanisms, advantages and limitations of current memory devices, Having a knowledge on emerging memory devices, advantages and limitations
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	The importance of data storage, current and emerging memory technologies will be emphasized in this course
LEARNING OUTCOMES OF THE COURSE	Students who successfully complete this course will have knowledge on current and emerging solid-state memory device technologies with the physics behind the devices.
TEXTBOOK	Ben Streetman, Sanjay Banerjee, Solid State Electronic Devices, Prentice Hall. Taur and Ning, Fundamentals of Modern VLSI devices, Cambridge University Press.
OTHER REFERENCES	Review and research papers will be available.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Materials, crystal structures, Energy bands, transport in semiconductors
2	Junctions (PN, metal-semiconductor)
3	Diodes, Solar cells, optoelectronik devices
4	MOS capacitors, Field effect transistors
5	Bipolar Junction transistors
6	Layout Design, Fabrication processes, deposition techniques, implantation
7	Fabrication processes, lithography techniques, etching
8	Magnetic storage, Optical storage
9	DRAM, SRAM
10	Flash Memory
11	Emerging memory technologies, MRAM, FRAM
12	Emerging memory technologies, RRAM
13	Emerging memory technologies, PCRAM
14	Course review
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☒	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☒	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☒	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Asst. Prof. Dr. Faruk Dirisaglik **Date:** 25/03/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	Pattern Recognition Fundamentals

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
		3

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm		
	Quiz		
	Homework	1	30
	Project	1	30
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Pattern recognition is the recognition of patterns and regularities in the data. Image, sound or any other forms of the data has been classified in pattern recognition problems. This course introduces the basic principles and methods of pattern recognition.
COURSE OBJECTIVES	The course aims to introduce the fundamental concepts of feature extraction and classification.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Students can use different data forms to realize a pattern recognition application that can be formed in many disciplines.
LEARNING OUTCOMES OF THE COURSE	-Feature extraction, -Classification, - Supervised/unsupervised learning, -Developing a pattern recognition application.
TEXTBOOK	-Jürgen Beyerer, Matthias Richter, Matthias Nagel, Pattern Recognition: Introduction, features, classifiers and principles, De Gruyter, ISBN 978-3-11-053793-2, 2018.
OTHER REFERENCES	-Geoff Dougherty, Pattern Recognition and Classification, Springer, ISBN 978-1-4614-5322-2, 2013.

	-Ulisses Braga-Neto, Fundamentals of Pattern Recognition and Machine Learning, Springer, ISBN 978-3-030-27655-3, 2020. -Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, ISBN 978-0387-31073-2, 2006.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction
2	Pattern recognition and machine learning
3	From pattern to features: Feature extraction and selection
4	Minimum eigenvalue method, Local binary patterns, Histogram of Gradients
5	Classification: Binary classification, multi-class classification
6	k-NN Classifiers, decision tree classifiers
7	Discriminant Analysis Classifiers
8	Midterm examinations week
9	Naive Bayes Classifiers
10	Support Vector Machine (SVM) Classifiers
11	Regression
12	Unsupervised learning: Clustering, k-means clustering, hierarchical clustering
13	Estimating and comparing classifiers: Bias,variance, cross validation, ROC curves
14	Evaluating pattern recognition problem
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☒	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☐	☒
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☒	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Dr. Öğr. Üyesi Hasan Serhan Yavuz **Date:** 25.03.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Spring

COURSE			
CODE	503102517	**TITLE**	Semiconductor Device Fabrication and Characterization

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm		
	Quiz	3	30
	Homework	3	30
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	Introductory level solid state physics and semiconductor devices
SHORT COURSE CONTENT	Electrical properties of materials, principles of semiconductor devices, Junctions, Field ffect transistors, bipolar junction transistors, fabrication processes (deposition, implantation, lithography, etching), electrical characterization techniques (I-V, C-V, hall measurements), optical characterization techniques (absorption, reflection, transmission, spectroscopy), electron microscopy
COURSE OBJECTIVES	Having an introductory knowledge on solid state physics, semiconductor devices, novel materials and devices, understanding the fabrication processes and basic characterization techniques.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	All aspects of semiconductor technology concerning materials and devices, their design, fabrication and characterization techniques will be covered.
LEARNING OUTCOMES OF THE COURSE	Students who successfully complete this course will be able to evaluate and interpret their knowledge on solid state physics and semiconductor devices. They will be aware of the current techniques and methods on semiconductor industry. They will be able to relate their knowledge from different discipilines such as physics, chemistry, biology and material sciences. They

	will be able to develop novel solutions for semiconductor devices, their design, fabrication and characterization.
TEXTBOOK	L. Solymar, D. Walsh, A. Syms, Electrical properties of materials. Oxford. Ben Streetman, Sanjay Banerjee, Solid State Electronic Devices, Prentice Hall. Taur and Ning, Fundamentals of Modern VLSI devices, Cambridge University Press. Robert F. Pierret, Semiconductor Device Fundamentals. Dieter Schroder, Semiconductor material and device characterization, Wiley.
OTHER REFERENCES	Review and research papers will be available.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Materials, crystal structures, Energy bands, transport in semiconductors
2	Junctions (PN, metal-semiconductor)
3	Diodes, Solar cells, optoelectronik devices
4	MOS capacitors, Field effect transistors
5	Bipolar Junction transistors
6	Layout Design
7	Fabrication processes, deposition techniques, implantation
8	Fabrication processes, lithography techniques, etching
9	Thin films, Device fabrication examples
10	Electrical characterization, I-V measurements, Resistivity, contact resistance, Schottky barriers
11	Carrier concentration, C-V measurements, Hall effect,
12	Optical characterization techniques (refection, transmission,spectroscopy)
13	Electron microscopy
14	Course review
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☒	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☒	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☒	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Asst. Prof. Dr. Faruk Dirisaglik **Date:** 25/03/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Fall

COURSE			
CODE		TITLE	Introduction To Mobile Robots

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
1	2	

ASSESSMENT CRITERIA

	Evaluation Type	Number	Contribution (%)
SEMESTER ACTIVITIES	Midterm		
	Quiz		
	Homework	3	60
	Project	1	40
	Report		
	Seminar		
	Other (……)		
	Final Examination		

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Locomotion, Kinematic models, Robot programming with Robot Operating System (ROS) and GAZEBO, Perception,Navigation,Collision avoidance behavior, Path planning, Coverage problem, Exploration problem, SLAM
COURSE OBJECTIVES	To know locomotion types for mobile robots. To be aware kinematic models for mobile robots. To introduce robot programming with ROS and GAZEBO. To know sensors that are able to employ mobile robots. To know navigation problem and behaviors to avoid collisions. To introduce basic algorithms for path planning, coverage, and explorations problems. To be aware SLAM problem and its basic algorithms.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	In this course, students will learn how to select locomotion properties, kinematic models, and sensors of robots to a specific problem. Besides, students will be familiar to sensors and algorithms that are able to use for navigation, path planning, coverage, exploration, and SLAM problems. Lastly, students will learn robot programming concepts to perform the tasks that are given to a robot.

LEARNING OUTCOMES OF THE COURSE	1) Students will learn locomotion, kinematic models, and sensors of a mobile robot. 2) Students will learn robot programming concepts with ROS and GAZEBO. 3) Students will learn navigation problem and collision avoidance approaches. 4) Students will learn basic path planning approaches. 5) Students will learn coverage and exploration problems and their basic approaches. 6) Students will learn SLAM and its basic approaches.
TEXTBOOK	Roland Siegwart, Illah Reza Nourbakhsh and Davide Scaramuzza, Introduction to Autonomous Mobile Robots, Second Edition, MIT Press, 2011.
OTHER REFERENCES	Howie Choset, Kevin M. Lynch, Seth Hutchinson, George A. Kantor, Wolfram Burgard, Lydia E. Kavraki and Sebastian Thrun, Principles of Robot Motion Theory, Algorithms, and Implementations, MIT Press, 2005. Maja J. Mataric, The Robotics Primer, MIT Press, 2007. John Holland, Designing Autonomous Mobile Robots Inside the Mind of an Intelligent Machine, Elsevier, 2004. Çeşitli web kaynakları

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction to Mobile Robots
2	Locomotion
3	Kinematic Models
4	ROS and GAZEBO, Robot Programming 1
5	ROS and GAZEBO, Robot Programming 2
6	Perception - Sensors 1
7	Perception - Sensors 2
8	Navigation and Collision Avoidance Behavior
9	Fundemantals of Path Planning
10	Coverage Problem
11	Exploration Problem
12	Localization - Kalman Filtering
13	Localization - Bayesian Methods
14	SLAM
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Asistant Prof. Burak Kaleci

Date: 31/01/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Spring

COURSE			
CODE		TITLE	Learning-Based Control

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
0	3	

ASSESSMENT CRITERIA

	Evaluation Type	Number	Contribution (%)
SEMESTER ACTIVITIES	Midterm		
	Quiz		
	Homework	2	20
	Project	1	40
	Report		
	Seminar		
	Other (……)	1	10
	Final Examination		30

PREREQUISITE(S)	This will be a research-focused course based primarily on the research literature. You should be comfortable: • finding, reading, and understanding conference and journal papers • identifying a novel research project, working independently on it, documenting your progress, and presenting your results
SHORT COURSE CONTENT	For deriving and implementing optimization and (reinforcement) learning techniques to control, this class will give a coherent treatment of abstract concepts, scalable computational tools, and rigorous experimental assessment.
COURSE OBJECTIVES	Modeling of some control problems as optimization problems and their solution with Reinforcement Learning approach.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Modeling and transferring to computer environment to solve some control problems with optimization approach, solving problems using computer tools.
LEARNING OUTCOMES OF THE COURSE	1.Defining the basic optimization problems and learning the solutions 2. Modeling Some Control Problems as Optimization Problems 3. To propose a suitable solution method for the solution of the modeled problems. 4. Transfers the problem model and solution method to the computer environment. 5. Combines, interprets, evaluates, discusses and finally

	organizes and presents the results of the study in writing. d6. Presents and defends his/her work orally
TEXTBOOK	R. S. Sutton and A. G. Barto. Reinforcement Learning: An Introduction. MIT Press, 2018, ISBN-10: 0262039249
OTHER REFERENCES	D. P. Bertsekas. Reinforcement Learning and Optimal Control, Athena Scientific, 2019, ISBN-10: 1886529396

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction; Control, stability, and metrics, learning, system identification
2	Unconstrained optimization, Constrained optimization
3	Dynamic programming, discrete LQR
4	Introduction to Deep Reinforcement Learning
5	Markov Decision Processes
6	Model-based RL
7	Model-free RL: policy gradient and actor critic
8	Model-based policy learning
9	Model-based policy learning
10	Optimal Control and Planning
11	Case Study: Deep Reinforcement Learning based solution of a control problem
12	Case Study: Deep Reinforcement Learning based solution of a control problem
13	Project presentations
14	Project presentations
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Asst. Prof. Kemal Keskin **Date:** 24/01/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING (MSc)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	Advanced Electromagnetic Theory

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7.5	COMPULSORY ( )	ELECTIVE (X)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm	1	30
	Quiz		
	Homework	2	30
	Project		
	Report		
	Seminar		
	Other ( )		
	Final Examination		40

PREREQUISITE(S)	
SHORT COURSE CONTENT	Maxwell's equations, time-harmonic waves, electrical properties of matter, plane waves, reflection and transmission, vector potentials, radiation and scattering equations, electromagnetic theorems, scattering by planar structures and physical optics, scattering by cylindrical structures, geometrical theory of diffraction
COURSE OBJECTIVES	Providing the students advanced theoretical information on electromagnetics for application in engineering problems.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Provide the theoretical background for research on electromagnetics.
LEARNING OUTCOMES OF THE COURSE	1. Solve the wave equation in simple medium. 2. Classify matter due to its electrical properties. 3. Analyze plane waves. 4. Express the field components in waveguides and cavity resonators. 5. Recognize advanced electromagnetic theorems.
TEXTBOOK	Constantine A. Balanis, Advanced Engineering Electromagnetics, 2nd edition, John Wiley and Sons, 2012

OTHER REFERENCES	John David Jackson, Classical Electrodynamics, 3rd edition, John Wiley & Sons Inc., 1999.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Maxwell's equations, time-harmonic waves
2	Eectrical properties of matter
3	Plane waves, reflection and transmission
4	Vector potentials
5	Radiation and scattering equations
6	Electromagnetic theorems
7	Electromagnetic theorems
8	Midterm Exam
9	Scattering by planar structures and physical optics
10	Scattering by planar structures and physical optics
11	Scattering by cylindrical structures
12	Scattering by cylindrical structures
13	Geometrical theory of diffraction
14	Geometrical theory of diffraction
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc PROGRAM LEARNING OUTCOMES		CONTRIBUTION LEVEL		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by : Prof. Dr. Gökhan ÇINAR **Date:** 28.03.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING (MSc)	SEMESTER	Fall

COURSE			
CODE		TITLE	Engineering Mathematics

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7.5	COMPULSORY ( )	ELECTIVE (X)	English

CREDIT DISTRIBUTION		
Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	Evaluation Type	Number	Contribution (%)
	Midterm	1	30
	Quiz		
	Homework	2	40
	Project		
	Report		
	Seminar		
	Other ( )		
		Final Examination	30

PREREQUISITE(S)	
SHORT COURSE CONTENT	Ordinary differential equations, systems of differential equations with ordinary derivatives, series solutions and special functions, Laplace transform, partial differential equations and Fourier analysis, functions with complex variables and their derivatives, analytical functions, integration on complex plane, Cauchy theorem an the law of residues, Taylor and Laurent series
COURSE OBJECTIVES	Provide fundamental knowledge in engineering mathematics and ability to analyze engineering problems mathematically
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Sufficient knowledge of engineering mathematics, ability to apply theoretical and practical knowledge on solving and modeling of engineering problems.
LEARNING OUTCOMES OF THE COURSE	1. Analysis of ordinary and partial differential equations 2. Applying mathematical models involving ordinary and partial differential equations on basic engineering problems 3. Analysis of fundamental problems related to functions with complex variables 4. Application of complex analysis on engineering
TEXTBOOK	Erwin Kreyszig, Advanced Engineering Mathematics, 10 ed, John Wiley and Sons, 2011.

OTHER REFERENCES	- Mithat İdemen, Kompleks Değişkenli Fonksiyonlar Teorisi, İTÜ Vakfı Yayınları, 2008. - Gökhan Uzgören ve Gökhan Çınar, Kompleks Değişkenli Fonksiyonlar Teorisi Çözümlü Problemler, İTÜ Vakfı Yayınları, 2017. - Mithat İdemen, Lineer Sınır Değer Problemleri, İTÜ Vakfı Yayınları, 2015.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Ordinary differential equations and systems of equations
2	Ordinary differential equations and systems of equations
3	Series solutions and special functions
4	Laplace transform
5	Partial differential equations and Fourier analysis
6	Partial differential equations and Fourier analysis
7	Partial differential equations and Fourier analysis
8	Midterm Exam
9	Functions with complex variables and their derivatives, analytical functions
10	Integration on complex plane and Cauchy theorem
11	The law of residues and evaluation of integrals on complex plane
12	The law of residues and evaluation of integrals on complex plane
13	Taylor series and some special functions
14	Laurent series and some special functions
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☒
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by : Doç. Dr. Özge YANAZ ÇINAR **Date:** 28.03.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Fall

COURSE			
CODE		TITLE	Intelligent Control Systems

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
	3	

ASSESSMENT CRITERIA

	Evaluation Type	Number	Contribution (%)
SEMESTER ACTIVITIES	Midterm		
	Quiz		
	Homework	3	30
	Project	1	40
	Report		
	Seminar		
	Other (……)		
	Final Examination		30

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Control foundations, Rule-based and Expert Control, Planning Systems, Learning and Function Approximation, Evolutionary Methods, Foraging, Bacteria, Bees, Swarm based Methods
COURSE OBJECTIVES	Modeling of some control problems as optimization problems and their solution with optimization approaches.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Modeling and transferring to computer environment to solve some control problems with optimization approach, solving problems using computer tools.
LEARNING OUTCOMES OF THE COURSE	1.Defining the basic optimization problems and learning the solutions 2. Modeling Some Control Problems as Optimization Problems 3. To propose a suitable solution method for the solution of the modeled problems. 4. Transfers the problem model and solution method to the computer environment. 5. Combines, interprets, evaluates, discusses and finally organizes and presents the results of the study in writing. 6. Presents and defends his/her work orally

TEXTBOOK	1- K. Passino, Biomimicry for Optimization, Control, and Automation, Springer Verlag, 2005 2- D. E. Kirk, Optimal Control Theory, Dover Publications, 2004
OTHER REFERENCES	Kevin M. Passino and Stephen Yurkovich, Fuzzy Control, Addison Wesley Longman, Menlo Park, CA, 1998.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction (Control foundations)
2	Elements of Decision Making - Neural network for control
3	Elements of Decision Making - Neural network for control
4	Elements of Decision Making - Rule-based Control
5	Elements of Decision Making - Planning systems
6	Elements of Decision Making - Planning systems
7	Learning - Learning and Control
8	Midterm week
9	Learning - Gradient Methods
10	Nature-inspired Optimization and Applications to Control and Modeling
11	Genetic algorithms, Simulated annealing, Random search, Downhill Simplex search, Particle Swarm Optimization.
12	Evolutionary Methods - Stochastic and Nongradient Optimization for Design
13	Project presentations
14	Project presentations
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☒	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☒
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☒
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Asst. Prof. Kemal Keskin **Date:** 24/01/2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Fall

COURSE			
CODE		TITLE	Power System Protction I

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
		3

ASSESSMENT CRITERIA

	Evaluation Type	Number	Contribution (%)
SEMESTER ACTIVITIES	Midterm	1	30
	Quiz		
	Homework		
	Project	1	30
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	The main objective of the course is to provide advanced knowledge the principles for power system protection. This course mainly focuses on the protection of various components of a power system including transmission lines, rotating machinery, transformers, busbars, reactors, capacitors and distribution lines. Fundamental features of a reliable protection system will be reviewed and the major components of a protection system including current and voltage transformers, circuit breakers, and relays will be discussed.
COURSE OBJECTIVES	The main objective of the course is to provide advanced knowledge the principles for power system protection.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	After completing this course, students shall understand to identify the challenges and solutions to industrial power system protection problems.
LEARNING OUTCOMES OF THE COURSE	Knowledge related to principles for power system protection of various components of a power system including transmission lines, rotating machinery

TEXTBOOK	Power System Relaying by Stanlley Horowitz & Arun Phadke, published by Wiley. Protective Relaying Principles and Applications , J. Lewis Blackburn & Tomas J. Domin, 4th Ed, CRC Press, © 2014.
OTHER REFERENCES	

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Power systems protection fundamentals
2	Symmetrical components and unbalanced faults
3	Power system grounding techniques and effects on faults currents
4	Relaying instrumentations: voltage transformers, current transformers, and effects of saturations
5	Dynamic response of current voltage measurement devices
6	Protection of generators, bus-bars and transformers
7	Protection of transmission systems
8	Protection of distribution systems
9	Protection against Transients and Surges
10	Arc Interruption Theory in Circuit Breaker, Types of Circuit Breakers and their Testing
11	Protection of Renewable Energy Systems
12	Measurement requirements and techniques in power systems
13	Power system state estimation
14	Wide-area monitoring and control using phasor measurement units
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Dr. Burak URAZEL **Date:** 24.03.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Spring

COURSE			
CODE		TITLE	Power System Protction II

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
		3

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	Evaluation Type	Number	Contribution (%)
	Midterm	1	30
	Quiz		
	Homework		
	Project	1	30
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	This course will cover the basic protection schemes that are used to detect and interrupt the faults in a power system. Fundamental principles of relaying will be discussed by having the following outline: Operating Principles of Relays, Over Current Relaying Based Protection, Distance Relays for transmission line protection, Differential Relays for protection of transformers and Digital Relaying.
COURSE OBJECTIVES	The main objective of the course is to provide an overview of the theory and practice of modern power system relaying.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	After completing this course, students shall understand the role of relaying in industrial power system protection problems.
LEARNING OUTCOMES OF THE COURSE	Knowledge related to principles for relaying in power system protection.
TEXTBOOK	Power System Relaying by Stanlley Horowitz & Arun Phadke, published by Wiley.

	Protective Relaying Principles and Applications , J. Lewis Blackburn & Tomas J. Domin, 4th Ed, CRC Press, © 2014.
OTHER REFERENCES	

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Introduction to power system relaying
2	Fault Current Analysis in a Power System
3	Fault Current Interruption Devices: Circuit Breakers and Fuses
4	Operating Principles of Relays
5	Overcurrent Relaying Based Protection
6	Distance Relays for transmission line protection
7	Differential Relays for protection of transformers
8	Machine protection
9	Numerical relay fundamentals
10	Relay Coordination Problems
11	Solution methods for relay coordination problems - part 1
12	Solution methods for relay coordination problems - part 2
13	Stability, reclosing, and load shedding
14	Integrated system and relay testing
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☐	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Dr. Burak URAZEL **Date:** 24.03.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Spring

COURSE			
CODE		**TITLE**	SEMICONDUCTOR POWER DEVICES

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
		3

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm	1	50
	Quiz		
	Homework		
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		50

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Fundamental semiconductor equations, PN structure and voltage-current relationships, Reverse biased PN junction diode, Forward biased PN junction diode, Power BJT, .Power MOSFET, Thyristors, Insulated Gate Bipolar Transistors (IGBT), Wide-band semiconductor devices
COURSE OBJECTIVES	In this course, semiconductor power devices including the PN diode, BJT, MOSFET, thyristor, and IGBT will be studied for their physical structure, their voltage-current characteristics, their difference from the low-power devices, and their models. The approaches to the design using these components will be discussed
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	To have a better understanding of semiconductor power devices To use the power devices more effectively and efficiently
LEARNING OUTCOMES OF THE COURSE	1)Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research. 2) Having extensive knowledge about contemporary techniques and methods applied in engineering. 3) Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.

TEXTBOOK	Muhammad H. RASHİD, POWER ELECTRONICS - Devices, Circuits, and Applications, 4th Ed. Pearson
OTHER REFERENCES	1) N. Mohan, T.M.Undeland, and W.P. Robbins, Power Electronics: Converters, Applications, and Design, New York: Wiley, 1989 2) D. A. Neamen, Semiconductor Physics and Devices: Basic Principles, New York: McGraw-Hill, 2003.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Semiconductor Physics
2	Fundamental equations
3	PN structure and voltage-current relationships
4	Reverse biased PN junction diode
5	Forward biased PN junction diode
6	Power BJT
7	BJT Switching
8	Midterms
9	Power MOSFET
10	Mosfet Switching
11	Thyristors
12	IGBT
13	Wide-gap devices
14	Other power devices
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☒	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Hasan Hüseyin ERKAYA **Date:** 01.04.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Fall

COURSE			
CODE		**TITLE**	SEMICONDUCTOR SOLAR CELLS

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
		3

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm	1	50
	Quiz		
	Homework		
	Project		
	Report		
	Seminar		
	Other (……)		
		Final Examination	50

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Sunlight, Solar energy, semiconductor Fundamentals, generation and recombination, basic semiconductor equations, PN structure and voltage-current relationships, Limits on efficiency, standard silicon technology, Solar Cell Design, Modules, solar energy systems.
COURSE OBJECTIVES	Teaching the operation principles of semiconductor solar cells, limitations and efficiency. Providing basic information about solar energy systems, and encouraging the students to use solar energy in practice.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	To have an understanding of semiconductor solar cells, their limitations, energy efficiencies, to gain ability to select the components of photovoltaic systems, and design battery storage systems.
LEARNING OUTCOMES OF THE COURSE	1)Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research. 2) Having extensive knowledge about contemporary techniques and methods applied in engineering. 3) Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.
TEXTBOOK	Martin A. Green, Third Generation Photovoltaics: Advanced solar Energy Conversion, Springer, 2006
OTHER REFERENCES	Martin A. Green, Solar Cells, Prentice Hall, 1982

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Sources of energy, Solar energy
2	Fundamental concepts and apparent motion of sun
3	semiconductor fundamentals
4	Generation and recombination
5	Basic semiconductor equations
6	Currents in a PN junction
7	İlluminated PN junction
8	Midterms
9	Efficiency limitations
10	Standard Silicon Technology
11	Solar Cell Design
12	Contacts
13	Module structure
14	Photovoltaic systems
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☒	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☒
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☒
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☒
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☒

Prepared by: Hasan Hüseyin ERKAYA **Date:** 01.04.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	ELECTRICAL ELECTRONICS ENGINEERING MSc (English)	SEMESTER	Fall

COURSE			
CODE		TITLE	Speech Production and Analysis

LEVEL	HOUR/WEEK			Credit	ECTS	TYPE		LANGUAGE
	Theory	Practice	Laboratory					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	Basic Engineering	Knowledge in the discipline [if it contains considerable design content, mark with (√)]
		0

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	Evaluation Type	Number	Contribution (%)
	Midterm	1	30
	Quiz	1	30
	Homework		
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	
SHORT COURSE CONTENT	rete Fourier Transform. Power Spectrum Estimation. The Mechanism of Speech Production. The Spectral Analysis. Time Domain Models for Speech Processing. Vocal Tract Modelling. Speech Synthesis Structures. Classification Methods
COURSE OBJECTIVES	To have basic knowledge about the speech production, analysis and synthesis.To learn pre-processing techniques of speech signals and to classify speech signals by applying resulting feature vectors to different classifiers.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	To provide a basis for the engineers working about the signal processing and classification.
LEARNING OUTCOMES OF THE COURSE	Students will analyze the time-domain speech signals in the frequency domain and they will model speech production mechanism and speech synthesis structure by using the methods given in this course. Meanwhile students will know how different parameters are extracted and they will apply these parameters to the training and testing stages of the classifiers for the recognition purposes.

TEXTBOOK	J.R. Deller, J.G. Proakis and J.H.L. Hansen, Discrete-Time Processing of Speech Signals, Macmillan, Inc
OTHER REFERENCES	1- A.V. Oppenheim and R.W. Schafer, Digital Signal Processing, Prentice-Hall,Inc. 2- J.D. Markel and A.H. Gray, Linear Prediction of Speech, Springer-Verlag. 3- L.R. Rabiner and R.W. Schafer, Digital Processing of Speech Signals, Prentice-Hall.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Discrete Fourier Transform (DFT)
2	Power Spectrum Estimation
3	Mechanism of Speech Production
4	Spectral Analysis
5	Time Domain Models for Speech Processing
6	Short Time Energy and Zero Crossing
7	First Midterm
8	Vocal Tract Modelling
9	Models for Speech Analysis
10	Linear Prediction Model
11	Relationship between LPC and Reflection Coefficients
12	Second Midterm
13	Speech Synthesis Structures
14	Classifiers
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☒	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☒	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☐	☒	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☒	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☒	☐	☐

Prepared by: Prof. Dr. M. Bilginer GÜLMEZOĞLU **Date:** 01.02.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Spring

COURSE			
CODE		**TITLE**	Signal Classification

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION

Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**
		X

ASSESSMENT CRITERIA

	Evaluation Type	**Number**	**Contribution (%)**
SEMESTER ACTIVITIES	Midterm	1	30
	Quiz		
	Homework	1	30
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		40

PREREQUISITE(S)	-
SHORT COURSE CONTENT	Digital Filters. Calculation of LPC and Cepstrum parameters from signals. Analysis of signals on the frequency domain. Bayes theorem. Distance measures. Dynamic Programming. Neural Networks. Linear Discriminant Analysis. Principal Component Analysis. Common Vector Approach
COURSE OBJECTIVES	To calculate the parameters representing any signal. To give the methods used in the signal classification. To learn the application of the methods in the training process. To give decision criteria or distance measures used in the testing process
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	To provide a basis for the engineers working on the signal processing and classification.
LEARNING OUTCOMES OF THE COURSE	1- Students will analyze any signal and will know that how the parameters are calculated from this signal. 2-Students will train any class by applying feature vectors consisting of parameters as an input to that class. 3- Students will recognize unknown signals by using trained classifier and various decision criteria. 4- Students will design optimum classifier according to database.

TEXTBOOK	M.D. Srinath, P.K. Rajasekaran and R. Viswanathan, Introduction to Statistical Signal Processing with Applications
OTHER REFERENCES	A.V. Oppenheim and R.W. Schafer, Digital Signal Processing, Prentice-Hall,Inc

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Digital filters
2	Calculation of linear predictive coefficients and cepstrum coefficients
3	Analysis of signals on the frequency domain
4	Bayes theorem
5	Distance measures and decision criteria
6	Dynamic programming
7	Midterm
8	Neural networks
9	Multilayer perceptrons and Kohonen's SOM
10	Linear discriminant analysis
11	Principal component analysis
12	Principal component analysis
13	Common vector approach (Insufficient data case)
14	Common vector approach (Sufficient data case)
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☒	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☐	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☒	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☒	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Prof. Dr. M. Bilginer GÜLMEZOĞLU **Date:** 01.02.2022

Signature:

T.R.

ESKISEHIR OSMANGAZI UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COURSE INFORMATION FORM

DEPARTMENT	**ELECTRICAL ELECTRONICS ENGINEERING MSc (English)**	**SEMESTER**	Spring

COURSE			
CODE	505702514	**TITLE**	Sensor Technologies

LEVEL	**HOUR/WEEK**			**Credit**	**ECTS**	**TYPE**		**LANGUAGE**
	Theory	**Practice**	**Laboratory**					
MSc	3	0	0	3	7,5	COMPULSORY ( )	ELECTIVE (x)	English

CREDIT DISTRIBUTION		
Basic Science	**Basic Engineering**	**Knowledge in the discipline [if it contains considerable design content, mark with (√)]**

ASSESSMENT CRITERIA			
SEMESTER ACTIVITIES	**Evaluation Type**	**Number**	**Contribution (%)**
	Midterm	1	40
	Quiz		
	Homework		
	Project		
	Report		
	Seminar		
	Other (……)		
	Final Examination		60

PREREQUISITE(S)	
SHORT COURSE CONTENT	Intoduction to sensors, sensor working principles, sensor fabrication techniques and sensor types.
COURSE OBJECTIVES	The students must comprehend the basic knowledges in the field of sensors.
COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION	Basic concepts, application and fabricaiton techniques of sensors will be thought to the students.
LEARNING OUTCOMES OF THE COURSE	-to learn basic information about sensors -to be able to anaylze sensors working principles -to use efficiently sensors depending on the field -to apply sensors in basic fields.
TEXTBOOK	Jon S. Wilson, Sensor Technology Handbook, 2005, Elsevier.
OTHER REFERENCES	Michael J. McGrath and Cliodhna Ni Scanaill, Sensor Technologies Healtcare, Wellness and Environmental Applications, 2013, Apres Open.

COURSE SCHEDULE (Weekly)	
WEEK	**TOPICS**
1	Intoduction to sensors
2	Basic working principles of sensors
3	Sensor fabrication techniques
4	Types of sensors
5	Sensor Applicaiton Areas
6	Sensors in the structural health monitoring
7	Midterm Exam
8	Physical and Chemical sensors
9	Biological and bio-sensors
10	Sensors in medicine and biomedical applicaitons
11	Key components of a sensor technology: Hardware and Software
12	Sensor network and its desing
13	Data collection and processing in sensors
14	Summary and Future Trends
15,16	Final Examination

CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING MSc in English PROGRAM LEARNING OUTCOMES		**CONTRIBUTION LEVEL**		
NO	**LEARNING OUTCOMES (MSc)**	**3** High	**2** Mid	**1** Low
LO 1	Ability to reach, evaluate, interpret, and apply knowledge in depth in the field of Electrical and Electronics Engineering through scientific research.	☐	☐	☐
LO 2	Having extensive knowledge about contemporary techniques and methods applied in engineering.	☒	☐	☐
LO 3	Ability to complete vague, limited or missing data using scientific methods and ability to use information from different disciplines.	☒	☐	☐
LO 4	Ability to identify and solve Electrical and Electronics Engineering problems.	☐	☐	☐
LO 5	Developing new and original ideas and methods; ability to develop innovative/alternative solutions in system, component or process design.	☒	☐	☐
LO 6	Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently and taking responsibility.	☐	☐	☐
LO 7	Ability to use a foreign language at an advanced level, ability to communicate in oral and written forms.	☐	☐	☐
LO 8	Awareness of social, environmental, health, safety, and legal issues of engineering applications and Project management.	☐	☐	☐
LO 9	Advanced level of Professional and ethical responsibility.	☐	☐	☐

Prepared by: Assoc. Prof. Dr. Malik KAYA

Date: 12/04/2021

Signature: