**ELECTRICAL ELECTRONICS ENGINEERING (English)MSc PROGRAMME**

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| **First Year** | | | | | | |
| **I. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 501001901 | [THE SCIENTIFIC RESEARCH METHODS AND ITS ETHICS](#d0) | 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 |  |  |

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| **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 |  | |  |  |  | |

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| **Elective Courses** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 505702512 | [ADVANCED DIGITAL SIGNAL PROCESSING](#d6) | 7.5 | 3+0+0 | 3 | E | English |
| 505701506 | [Advanced Electromagnetic Theory](#d23) | 7.5 | 3+0+0 | 3 | E | English |
| 505702502 | [Advanced Power Electronics](#d1) | 7.5 | 3+0+0 | 3 | E | English |
| 505702509 | [Antenna Theory and Design](#d3) | 7.5 | 3+0+0 | 3 | E | English |
| 505702501 | [Bezier Curve Modelling](#d13) | 7.5 | 3+0+0 | 3 | E | English |
| 505702504 | [DATA COMPRESSION](#d5) | 7.5 | 3+0+0 | 3 | E | English |
| 505702508 | [Deep Learning](#d11) | 7.5 | 3+0+0 | 3 | E | English |
| 505701504 | [DIGITAL COMMUNICATION USING FPGA](#d8) | 7.5 | 3+0+0 | 3 | E | English |
| 505701515 | [DIGITAL SIGNAL PROCESSING](#d7) | 7.5 | 3+0+0 | 3 | E | English |
| 505701514 | [Engineering Mathematics](#d24) | 7.5 | 3+0+0 | 3 | E | English |
| 505702506 | [GROUNDING AND SHIELDING TECHNIQUES IN INSTRUMENTATION](#d14) | 7.5 | 3+0+0 | 3 | E | English |
| 505701512 | [Intelligent Control Systems](#d25) | 7.5 | 3+0+0 | 3 | E | English |
| 505701501 | [Introduction to Linear Transformations](#d15) | 7.5 | 3+0+0 | 3 | E | English |
| 505701502 | [Introduction To Mobile Robots](#d21) | 7.5 | 3+0+0 | 3 | E | English |
| 505702510 | [Learning-Based Control](#d22) | 7.5 | 3+0+0 | 3 | E | English |
| 505701508 | [Linear Programming for Engineering Sciences](#d16) | 7.5 | 3+0+0 | 3 | E | English |
| 505701505 | [Memory devices and technologies](#d18) | 7.5 | 3+0+0 | 3 | E | English |
| 505701507 | [MEMS BASED ACCELEROMETERS and NAVIGATION](#d17) | 7.5 | 3+0+0 | 3 | E | English |
| 505701510 | [Microwave Techniques and Applicaitons](#d4) | 7.5 | 3+0+0 | 3 | E | English |
| 505701516 | [OPTIMAL POWER SYSTEM OPERATION I](#d9) | 7.5 | 3+0+0 | 3 | E | English |
| 505702513 | [OPTIMAL POWER SYSTEM OPERATION II](#d10) | 7.5 | 3+0+0 | 3 | E | English |
| 505701511 | [Pattern Recognition Fundamentals](#d19) | 7.5 | 3+0+0 | 3 | E | English |
| 505701503 | [Power System Protction I](#d26) | 7.5 | 3+0+0 | 3 | E | English |
| 505702503 | [Power System Protction II](#d27) | 7.5 | 3+0+0 | 3 | E | English |
| 505702505 | [Semiconductor Device Fabrication and Characterization](#d20) | 7.5 | 3+0+0 | 3 | E | English |
| 505702507 | [SEMICONDUCTOR POWER DEVICES](#d28) | 7.5 | 3+0+0 | 3 | E | English |
| 505701509 | [SEMICONDUCTOR SOLAR CELLS](#d29) | 7.5 | 3+0+0 | 3 | E | English |
| 505702514 | [Sensor Technologies](#d32) | 7.5 | 3+0+0 | 3 | E | English |
| 505702511 | [Signal Classification](#d31) | 7.5 | 3+0+0 | 3 | E | English |
| 505701513 | [Speech Production and Analysis](#d30) | 7.5 | 3+0+0 | 3 | E | English |

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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

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| **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. | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Power Electronics |

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| **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 | | | | |  | |  |
| 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 | | | | | | | |

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| **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 |

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| **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**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | DESIGN OF ELECTRICAL MACHINES |

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| **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. | | | | | | | |

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| **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 |

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| **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**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Antenna Theory and Design |

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| **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 | | | | |  | |  |
| 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** | | | | | - | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Microwave Techniques and Applicaitons |

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| **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 (√)]** | | | | | | |
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| **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** | | | | | - | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | DATA COMPRESSION |

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| **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** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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, 2003I.M. Pu, Fundamental Data Compression, Butterworth-Heinemann, 2006 | | | | | | | |

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| **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 |

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| **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. |  |  |  |

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

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | ADVANCED DIGITAL SIGNAL PROCESSING |

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| **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 (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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, 2000A. V. Oppenheim, R. W. Schafer: Discrete-time signal processing, Prentice Hall, 1999, 2nd edition | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | DIGITAL SIGNAL PROCESSING |

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| **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 (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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., 1999J.G.Proakis, D.G. Manolakis, “Digital Signal Processing”, 4th Ed., Pearson International Edition, Upper Saddle River, NJ 07458, 2007. ISBN 9780131873741. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | DIGITAL COMMUNICATION USING FPGA |

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| **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** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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 | | | | | | | |

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| **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 |

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| **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. |  |  |  |

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

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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

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| **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** | | | | |  | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | OPTIMAL POWER SYSTEM OPERATION II |

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| **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** | | | | | 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 | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Deep Learning |

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| **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. | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Image Processing |

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| **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 | | 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). | | | | | | | |

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| **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 |

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| **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**

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

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| **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** | | | | | | | -- | | | | | | | | |

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| **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 |

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| **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**

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

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

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| **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** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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 Technıques in Instrumentation, Ralph MORRISON | | | | | | | |
| **OTHER REFERENCES** | | | | | Noise Reduction Techniques in Electronic Systems, Henry W. Ott | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Introduction to Linear Transformations |

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| **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)** | | | | | 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** | | | | |  | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Linear Programming for Engineering Sciences |

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| **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 | | | | | | | |

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| **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 |

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| **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**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **ELECTRICAL ELECTRONICS ENGINEERING MSc ( English)** | **SEMESTER** |  |

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

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| **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** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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 WilliamsMEMS and Microstructures in Aerospace Applications, Robert Osiander, M.Ann Garrison Darrin, John L. Champion | | | | | | | |

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| **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 |

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| **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**

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

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

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| **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 (√)]** | | | | | | |
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| **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. | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Pattern Recognition Fundamentals |

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| **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. | | | | | | | |

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| **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 |

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| **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**

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

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

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| **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 (√)]** | | | | | | |
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| **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. | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Introduction To Mobile Robots |

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| **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** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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 | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Learning-Based Control |

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| **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** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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 | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Advanced Electromagnetic Theory |

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| **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 (√)]** | | | | | | |
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| **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. | | | | | | | |

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| **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 |

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| **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. |  |  |  |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Engineering Mathematics |

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| **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 (√)]** | | | | | | |
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| **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. | | | | | | | |

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| **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 |

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| **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. |  |  |  |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Intelligent Control Systems |

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| **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 | | | | | 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, 20052- 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. | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Power System Protction I |

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| **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** | | | | | 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** | | | | |  | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Power System Protction II |

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| **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** | | | | |  | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | SEMICONDUCTOR POWER DEVICES |

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| **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** | | | | | 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, 19892) D. A. Neamen, Semiconductor Physics and Devices: Basic Principles, New York: McGraw-Hill, 2003. | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | SEMICONDUCTOR SOLAR CELLS |

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| **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 | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Speech Production and Analysis |

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| **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. | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Signal Classification |

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| **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** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| 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 | | | | | | | |

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| **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 |

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| **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**

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

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| **COURSE** | | | |
| **CODE** | 505702514 | **TITLE** | Sensor Technologies |

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| **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. | | | | | | | |

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| **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 |

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| **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. |  |  |  |
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| **LO 9** | Advanced level of Professional and ethical responsibility. |  |  |  |

**Prepared by:** Assoc. Prof. Dr. Malik KAYA **Date:** 12/04/2021

**Signature**: