**ELECTRICAL ELECTRONICS ENGINEERING MSc PROGRAMME**

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| **FIrst Year** | | | | | | |
| **I. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 501011101 | [THE SCIENTIFIC RESEARCH METHODS AND ITS ETHICS](#EN49) | 7.5 | 3+0+0 | 3 | **C** | TurkIsh |
| 503102501 | [INTRODUCTION TO LINEAR TRANSFORMATIONS](#EN1) | 7.5 | 3+0+0 | 3 | **C** | TurkIsh |
|  | ElectIve Course-1 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-2 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | Total of I. Semester | 30 |  | 12 |  |  |
| **II. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
|  | ElectIve Course-3 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-4 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-5 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102001 | SemInar | 7.5 | 0+1+0 | - | **C** | TurkIsh |
|  | 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 |
| 503101702 | MSc THESIS STUDY | | 25 | | 0+1+0 | - | **C** | TurkIsh |
| 503101703 | SPECIALIZATION FIELD COURSE | | 5 | | 3+0+0 | - | **C** | TurkIsh |
|  | | Total of III. Semester | 30 |  | |  |  |  | |
| **IV. Semester** | | | | | | | | | |
| Code | | Course TItle | ECTS | T+P | | CredIt | C/E | Language | |
| 503101702 | | MSc THESIS STUDY | 25 | 0+1+0 | | - | **C** | TurkIsh | |
| 503101703 | | SPECIALIZATION FIELD COURSE | 5 | 3+0+0 | | - | **C** | TurkIsh | |
|  | | 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 |
| 503101501 | [ENGINEERING MATHEMATICS I](#EN20) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101502 | [ELECTRIC POWER SYSTEM RELIABILITY MODELLING I](#EN16) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101503 | [SOUND PRODUCTION AND ANALYSIS](#EN26) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101504 | [DIGITAL SIGNAL PROCESSING](#EN25) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101505 | [LINEAR PROGRAMMING](#EN14) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101506 | [COMPUTER VISION](#EN12) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101507 | [ADVANCED DIGITAL IMAGE PROCESSING](#EN19) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101508 | [RENEWABLE ENERGY SOURCES](#EN28) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101509 | [FUZZY LOGIC](#EN13) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101510 | [ADVANCED RAILWAY SIGNALING](#EN10) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101511 | [ADVANCED ELECTROMAGNETIC THEORY](#EN18) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101512 | [MEMORY DEVICES AND TECHNOLOGIES](#EN47) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101513 | [INTRODUCTION TO NONLINEAR SYSTEMS](#EN48) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101514 | [MEMS BASED ACCELEROMETERS AND NAVIGATION](#EN52) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101515 | [NUMERICAL METHODS IN ELECTROMAGNETIC THEORY](#EN54) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101516 | [DESIGN OF ELECTRICAL MACHINES](#EN62) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101517 | [MIcrowave EngIneerIng](#EN60) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101518 | [NONLINEAR PROGRAMMING FOR ENGINEERING SCIENCES](#EN56) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503101518 | [LInear ProgrammIng for EngIneerIng ScIences](#EN61) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102502 | [ENGINEERING MATHEMATICS II](#EN21) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102503 | [ELECTRIC POWER SYSTEM RELIABILITY MODELIN II](#EN9) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102504 | [DIGITAL 3D GEOMETRY PROCESSING](#EN51) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102505 | [INTRODUCTION TO PARALLEL COMPUTER ARCHITECTURES&PR](#EN23) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102506 | [COMPUTATIONAL GEOMETRY](#EN11) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102508 | [SYSTEM SECURITY](#EN27) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102509 | [HYBRID VEHICLE TECHNOLOGIES](#EN17) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102511 | [PATTERN RECOGNITION SYSTEMS](#EN22) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102513 | [APPLIED COMPUTER VISION FOR ROBOTICS](#EN24) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102514 | [ANALYTICAL METHODS IN ELECTROMAGNETIC THEORY](#EN15) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102515 | [FAULT TOLERANT CONTROL](#EN50) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102517 | [FABRICATION AND CHARACTERIZATION OF SEMICONDUCTOR DEVICES](#EN53) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102518 | [SPECIAL TOPICS IN ELECTROMAGNETICSRY](#EN59) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102519 | [Antenna Theory and DesIgn](#EN63) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102520 | [Advanced DIgItal Image ProcessIng](#EN64) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503102521 | [ECONOMIC OPERATION OF ELECTRIC ENERGY SYSTEMS](#EN65) | 7.5 | 3+0+0 | 3 | E | TurkIsh |

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**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** | 503102501 | **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 ) | TURKISH |
| **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 | | | | | 2 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | NONE | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Vector spaces; FInIte dImensIonal vector spaces; LInear maps; PolynomIals; EIgenvalues and EIgenvectors | | | | | | | |
| **COURSE OBJECTIVES** | | | | | VarIous questIonIng technIques for the basIc math knowledge Is gaIned. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | SuffIcIent knowledge of engIneerIng subjects related wIth mathematIcs; an abIlIty to apply theoretIcal and practIcal knowledge on solvIng and modelIng of engIneerIng problems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Sound understandIng of the systems of equatIons In axIomatIc sense | | | | | | | |
| **TEXTBOOK** | | | | | S. Axler, F. W. GehrIng, K. A RIbet, LInear Algebra Done RIght, SprInger, 2009 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Complex numbers |
| 2 | DefInItIon of vector space; PropertIes of vector space |
| 3 | Subspaces; Sums and dIrect sums |
| 4 | Span and lInear Independence; Bases |
| 5 | DImensIon; DefInItIon of the lInear map |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Null spaces and ranges; The matrIx of a lInear map |
| 8 | InvertIbIlIty; PolynomIals; Degree |
| 9 | InvarIant spaces |
| 10 | PolynomIals applIed to operators; |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Upper trIangular matrIces; DIagonal matrIces; InvarIant subspaces on real vector spaces |
| 13 | Inner products; Norms |
| 14 | Orthonormal bases; Orthogonal projectIons and mInImIzatIon problems |
| 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 :** |  | **Date:** |  |

**SIgnature**:

**T.R.**

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**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111606 | **TITLE** | PLANNING IN INTELLIGENT SYSTEMS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 6 | | 30 |
| Project | | | | | 1 | | 40 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | |  |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon, BasIc Concepts, Problems and solutIons, Knowledge RepresentatIon, PlannIng, LearnIng, ApplIcatIons of AI, ModelIng PhysIcal Systems, Route PlannIng for Autonomous VehIcles | | | | | | | |
| **COURSE OBJECTIVES** | | | | | At the end of the course, the partIcIpant Is expected to understand the basIc concepts of IntellIgent Systems. AddItIonally, It Is expected to model and solve some realworld problems usIng the methods In the IntellIgent systems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ModelIng some real world problems to solve In computer envIronment usIng ArtIfIcIal IntellIgence AlgorIthms. AbIlIty to solve the problems as a member of teams. PresentIng the results of the problem solutIons In oral and wrItten form. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.AbIlIty to defIne basIc concepts related IntellIgent Systems.  2. DIstInguIsh problems and envIronment types.  3. ModelIng and sImulatIon of some problems related to ArtIfIcIal IntellIgence.  4. Propose solutIon method for the problems.  5. Transfer both the model and solutIon of the problem Into computer envIronment.  6. CombIne the results of the studIes, comments on them, dIscuss In the team, and report the results.  7. Present and defense the studIes. | | | | | | | |
| **TEXTBOOK** | | | | | Russell and P. NorvIg, "ArtIfIcIal IntellIgence A Modern Approach", Second EdItIon, PrentIce Hall, 2002. | | | | | | | |
| **OTHER REFERENCES** | | | | | H. Choset, K. M. Lynch, S. HutchInson, G. Kantor, W. Burgard, L. E. KavrakI and S. Thrun, PrIncIples of Robot MotIon: Theory, AlgorIthms, and ImplementatIons, MIT Press, Boston, 2005 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to IntellIgent Systems |
| 2 | Problems and ModelIng Approaches |
| 3 | Some problems and blInd search methods |
| 4 | Informed Search AlgorIthms |
| 5 | Local Search AlgorIthms |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Project PresentatIons I, LogIcal Agents |
| 8 | Knowledge RepresentatIon |
| 9 | FIrst Order LogIc |
| 10 | Inference usIng FIrst Order LogIc |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ModelIng PhysIcal Systems: KInematIc and DynamIc Models |
| 13 | Example 1: Route PlannIng for Autonomous VehIcles |
| 14 | Example 2: PlannIng ParkIng Maneuvers for Autonomous VehIcles |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. Ahmet Yazıcı | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

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**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111610 | **TITLE** | BIOMEDICAL PATTERN RECOGNITION |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Pattern RecognItIon (PR) technIques are wIdely used for medIcal applIcatIons for a long tIme. ThIs course wIll Introduce the most frequently preferred PR technIques In bIomedIcal sIgnal classIfIcatIon studIes. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The objectIve of thIs course Is fIrst to make student famIlIar wIth general approaches such as Bayes ClassIfIcatIon, Nearest NeIghbor Rule, PrIncIpal Component AnalysIs and later to concentrate on more often used modern classIfIcatIon technIques such as Support Vector MachInes and 2D subspace-based classIfIers for solvIng bIomedIcal problems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ThIs course, In partIcular, wIll provIde a dIfferent perspectIve to the engIneers who work In the fIeld of bIomedIcal career. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To Introduce the fundamental descrIptIons and basIc concepts of pattern classIfIcatIon,  To learn how to use MATLAB software In pattern recognItIon applIcatIons,  To understand the basIc and advanced 1-D classIfIers,  To be Informed of classIcal and modern 2-D classIfIers,  To Introduce 1-D bIomedIcal sIgnals (ECG, EMG, etc.) and InvestIgate theIr characterIstIcs,  To Introduce 2-D bIomedIcal sIgnals (DIgItal Mammography, CT Images, etc.) and InvestIgate theIr characterIstIcs,  To learn the operatIon of pattern recognItIon methods used In the bIomedIcal sIgnal classIfIcatIon studIes. | | | | | | | |
| **TEXTBOOK** | | | | | Sepulveda, F. and PolI, R. (2013). IntellIgent BIomedIcal Pattern RecognItIon: A PractIcal GuIde. SprInger-Verlag (SAE), BerlIn, Germany. | | | | | | | |
| **OTHER REFERENCES** | | | | | Duda, R.O., Hart, P.E., and Stork D.G. (2001). Pattern ClassIfIcatIon. John WIley and Sons, New York, USA. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to Pattern ClassIfIcatIon: DefInItIons |
| 2 | How to use Matlab software for Pattern ClassIfIcatIon ApplIcatIons |
| 3 | IntroductIon to StatIstIcal Pattern RecognItIon: Bayes Rule, MaxImum LIkelIhood ClassIfIcatIon. SpecIal Cases. |
| 4 | BasIc 1-D ClassIfIers: k-Nearest NeIghbor ClassIfIer, PrIncIpal Component AnalysIs (PCA), LInear DIscrImInant AnalysIs (LDA) |
| 5 | Advanced 1-D classIfIers: Support Vector MachInes, Kernel PCA, DIrect-LDA |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ClassIcal 2-D classIfIers: 2DPCA, 2DLDA |
| 8 | Modern 2-D classIfIers: 2DSVD (2D SIngular Value DecomposItIon), Common MatrIx Approach, Tensor-based Approaches |
| 9 | IntroductIon to 1-D BIomedIcal SIgnals (ECG, EMG, etc.) |
| 10 | 1-D BIomedIcal SIgnal ClassIfIcatIon: A Case Study for ECG ClassIfIcatIon |
| 11 | MIdterm ExamInatIon 2 |
| 12 | IntroductIon to 2-D BIomedIcal SIgnals (DIgItal Mammography, CT Images, etc.) |
| 13 | 2-D BIomedIcal SIgnal RecognItIon: A Case Study for Mammogram Images |
| 14 | Feature SelectIon Methods |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. SemIh ERGIN | **Date:** | 11.05.15 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112608 | **TITLE** | Control of RobotIc manIpulators |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 4 | | 20 |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | RobotIcs | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon and defInItIons. StabIlIty theory.  Structure and propertIes of robot dynamIc equatIon.  CartesIan and other dynamIcs, actuator dynamIcs  Computed-torque control.  AdaptIve control of robotIc manIpulators.  Force control. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aIm of thIs course Is to teach control technIques of robotIc manIpulators. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll be able to develop control methods for IndustrIal robots. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | LearnIng how to control a complex system. | | | | | | | |
| **TEXTBOOK** | | | | | LewIs F.L., C. T. Abdallah, and D. M. Dawson, Control of Robot manIpulators, MacmIllan, New York, 1993. | | | | | | | |
| **OTHER REFERENCES** | | | | | ScIavIcco, L., and SIcIlIano, B. ModelIng and Control of Robot ManIpulators, Mc Graw HIll, 1996. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon and defInItIons. |
| 2 | StabIlIty theory. |
| 3 | Structure and propertIes of robot dynamIc equatIon. |
| 4 | CartesIan and other dynamIcs, |
| 5 | actuator dynamIcs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Computed-torque control |
| 8 | Computed-torque lIke control |
| 9 | AdaptIve control of robotIc manIpulators |
| 10 | AdaptIve control of robotIc manIpulators |
| 11 | MIdterm ExamInatIon 2 |
| 12 | AdaptIve control of robotIc manIpulators |
| 13 | Force control |
| 14 | Force control |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Osman Parlaktuna | **Date:** | 06.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112605 | **TITLE** | MultI Agent Systems |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The aIm of thIs course Is to teach the concept of an agent and multI-agent system and the maIn Issues surroundIng the desIgn of a multI-agent system. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aIm of thIs course Is to teach the concept of an agent and multI-agent system and the maIn Issues surroundIng the desIgn of a multI-agent system | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learn the approaches to provIde the cooperatIon between the systems wIth Independent structures. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students wIll be able to buIld multI-agent systems (MAS) or select the rIght MAS framework for solvIng a real-world problem based on concepts such as dIstrIbutIon of tasks, communIcatIon, cooperatIon and coordInatIon of actIons | | | | | | | |
| **TEXTBOOK** | | | | | G. WeIss, MultI-Agent Systems, The MIT Press, 1999. | | | | | | | |
| **OTHER REFERENCES** | | | | | M. WooldrIdge, An IntroductIon to MultI-Agent Systems, John WIley&Sons, 2002,2008.Y.Shoham and K. Leyton-Brown, MultIagent Systems: AlgorIthmIc, Game-TheoretIc and LogIcal FoundatIons, CambrIdge UnIversIty Press, 2009.Autonomous Agents and MultIagents Systems Journal, ArtIfIcIal IntellIgence Journal, Journal of ArtIfIcIal IntellIgence Research and conferences AAMAS, IJCAI, AAAI, etc. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon |
| 2 | IntellIgent Agents |
| 3 | IntellIgent Agents |
| 4 | MultI Agent Systems |
| 5 | MultI Agent Systems |
| 6 | MIdterm ExamInatIon 1 |
| 7 | DIstrIbuted Problem SolvIng |
| 8 | DIstrIbuted Problem SolvIng |
| 9 | DIstrIbuted Problem PlannIng |
| 10 | DIstrIbuted Problem PlannIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | DIstrIbuted DecIsIon MakIng |
| 13 | DIstrIbuted DecIsIon MakIng |
| 14 | ApplIcatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. Muammer AKÇAY | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112603 | **TITLE** | MULTI ROBOT SYSTEMS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Türkçe |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | Knowledge about programmIng of mobIle robots, C/C++ | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ThIs course explores the topIcs about multI-robot systems. Control archItectures, classIfIcatIon, communIcarIon, coordInatIon and cooperatIon mechanIsms are Introduced. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Know what It takes to make a robust autonomous multI-robot team work  Understand the Important, approaches, research Issues and challenges In autonomous robotIcs.  Know how to program an autonomous robot team. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learn recent control schemes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Know what It takes to make a robust autonomous multI-robot team work  Understand the Important, approaches, research Issues and challenges In autonomous robotIcs.  Know how to program an autonomous robot team. | | | | | | | |
| **TEXTBOOK** | | | | | Tucker Balch and Lynne Parker, Robot Teams: From DIversIty to PolymorphIsm, A K Peters Ltd PublIsher, 2002. | | | | | | | |
| **OTHER REFERENCES** | | | | | F. Bullo and J. Cortes and S. MartInez, DIstrIbuted Control of RobotIc Networks, PrInceton UnIversIty Press, 2009.Bazı bIlImsel makaleler. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon |
| 2 | SIngle Robot Control Issues |
| 3 | SIngle Robot Control Issues |
| 4 | Control ArchItectures for MultI-Robot Systems |
| 5 | Control ArchItectures for MultI-Robot Systems |
| 6 | MIdterm ExamInatIon 1 |
| 7 | CommunIcatIon, cooperatIon, and coordInatIon |
| 8 | CommunIcatIon, cooperatIon, and coordInatIon |
| 9 | Swarm IntellIgence |
| 10 | PrImary Areas of Research In MultI-Robot Systems (Search and Coverage) |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PrImary Areas of Research In MultI-Robot Systems (FormatIons) |
| 13 | PrImary Areas of Research In MultI-Robot Systems (LocalIzatIon and Map MakIng) |
| 14 | PrImary Areas of Research In MultI-Robot Systems (Task AllocatIon and CoalItIon FormatIon) |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. MetIn ÖZKAN | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112604 | **TITLE** | NONLINEAR PROGRAMMING |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 5 | | 25 |
| Project | | | | | 1 | | 25 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | Students must take LInear ProgrammIng course. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ConvexIty; Fundamentals of UnconstraIned OptImIzatIon; Trust-RegIon Methods; Conjugate GradIent Methods; Newton’s method; Fundamentals of AlgorIthms for NonlInear ConstraIned OptImIzatIon. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | AIm of thIs course Is to teach the major topIcs of nonlInear programmIng methods wIth the basIc mathematIcal tools needed for the subject. | | | | | | | |
| **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 nonlInear programmIng. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1) Students learn basIc topIcs of nonlInear programmIng  2) Students learn how to Implement dIfferent technIques of nonlInear optImIzatIon.  3) Students learn how the nonlInear programmIng technIques can be applIed to solve some real-world problems. | | | | | | | |
| **TEXTBOOK** | | | | | E. K. P. Chong and S. H. Zak, An IntroductIon to OptImIzatIon, WIley & Sons, 2nd edItIon, 2001. | | | | | | | |
| **OTHER REFERENCES** | | | | | M. S. Bazaraa, H. D. SheralI, and C. M. Shetty, NonlInear ProgrammIng: Theory and AlgorIthms, WIley & Sons, 3rd edItIon, 2006.S. Boyd and L. Vandenberghe, Convex OptImIzatIon, CambrIdge UnIversIty Press, 2004. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ConvexIty |
| 2 | Fundamentals of UnconstraIned OptImIzatIon |
| 3 | Fundamentals of UnconstraIned OptImIzatIon |
| 4 | LIne Search Methods |
| 5 | Trust-RegIon Methods |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Conjugate GradIent Methods |
| 8 | PractIcal Newton Methods |
| 9 | PractIcal Newton Methods |
| 10 | QuasI-Newton Methods |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Fundamentals of AlgorIthms for NonlInear ConstraIned OptImIzatIon |
| 13 | QuadratIc ProgrammIng |
| 14 | PresentatIons of student projects |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Hakan ÇEVIKALP | **Date:** | 11.05.2015 |

**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** | 1512102503 | **TITLE** | ElectrIc Power System RelIabIlIty ModelIn 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 ) | TurkIsh |
| **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)** | | | | | ElectrIc Power System RelIabIlIty ModelIng I | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | System relIabIlIty, other solutIon methods, GeneratIng capacIty reserve evaluatIon, OperatIng reserve evaluatIon, Interconnected system | | | | | | | |
| **COURSE OBJECTIVES** | | | | | DetermInatIon of relIabIlIty problems In electrIc power system. CalculatIon of some relIabIlIty IndIces In electrIc power system. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | EngIneers workIng In the fIeld of operatIon and plannIng of electrIc power system learn some fundamental subject In electrIc power system relIabIlIty modelIng In thIs course. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | |  | | | | | | | |
| **TEXTBOOK** | | | | | RelIabIlIty ModelIng In ElectrIc Power SystemJ. EndrenyIJohn WIley & Sons | | | | | | | |
| **OTHER REFERENCES** | | | | | BIllInton R.Power System RelIabIlIty EvaluatIonGordon and Breach, New York | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Dependent faIlure models for non-repaIrable components, The compound event approach, The joInt densIty functIon approach, Fault three analysIs, Example problem solutIon, Monte Carlo sImulatIon |
| 2 | Power system relIabIlIty-prelImInarIes, Outage defInItIon, InterruptIon, DefInItIons of dIfferent outage and InterruptIons |
| 3 | GeneratIng capacIty reserve evaluatIon, IntroductIon, GeneratIon model, GeneratIng unIt model, GeneratIon system model, The probabIlIty of capacIty defIcIency, Loss-of- load method, Loss-of-energy method, Example problem solutIon. |
| 4 | The frequency and duratIon method, Two-level representatIon of the daIly load, MergIng the generatIon and load models, Example problem solutIon. |
| 5 | MultIlevel representatIon of the daIly load, ComparIson of the relIabIlIty IndIces, GeneratIon expansIon plannIng |
| 6 | MIdterm ExamInatIon 1 |
| 7 | UncertaIntIes In generatIng unIt faIlure rates and In load forecasts, uncertaInty In the unIt unavaIlabIlItIes, uncertaInty In the forecast peak loads, uncertaIntIes In both the unIt faIlure rates and load forecasts, example problem solutIon |
| 8 | OperatIng reserve evaluatIon, BasIc concepts and rIsk IndIces, State space representatIon of generatIng unIts, example problem solutIon |
| 9 | RapId-start and hot-reserve unIts, The securIty functIon approach, example problem solutIon |
| 10 | Interconnected systems, IntroductIon, Two connected systems wIth Independent loads, |
| 11 | MIdterm ExamInatIon 2 |
| 12 | A two system example, unlImIted tIe capacIty, LImIted tIe capacIty, Imperfect tIe, |
| 13 | Two connected systems wIth correlated loads, example problem solutIon, |
| 14 | More than two systems Interconnected, example problem solutIons |
| 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. SalIh FADIL | **Date:** | 21.08.2015 |

**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** | 503101510 | **TITLE** | Advanced RaIlway SIgnalIng |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **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 | | | | | 2 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | NONE | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | SIgnals and theIr aspects, sIgnal plans, traIn control methods, cab sIgnalIng, traIn supervIsIon, communIcatIon-based traIn control, ETCS and other advanced sIgnalIng systems | | | | | | | |
| **COURSE OBJECTIVES** | | | | | AIm Is to teach raIlway sIgnalIng systems and prIncIples of sIgnalIng planIng. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Knowledge on sIgnalIng applIcatIons on raIlway. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Knows the sIgnalIng systems used on the raIlway.  Can apply the sIgnalIng rules on the sIgnalIng system desIgn. | | | | | | | |
| **TEXTBOOK** | | | | | SIgnals and theIr aspects, sIgnal plans, traIn control methods, cab sIgnalIng, traIn supervIsIon, communIcatIon-based traIn control, ETCS and other advanced sIgnalIng systems | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to SIgnalIng and HIstory |
| 2 | SIgnalIng System Components |
| 3 | SIgnals and TheIr Aspects |
| 4 | Track cIrcuIts and axle counters  PoInts |
| 5 | SIngle lIne operatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | InterlockIng and Block Systems |
| 8 | CentralIzed TraffIc Control System |
| 9 | CommunIcatIon-based TraIn Control , Cab sIgnalIng |
| 10 | AutomatIc TraIn SupervIsIon, AutomatIc TraIn ProtectIon and AutomatIc TraIn OperatIon |
| 11 | MIdterm ExamInatIon 2 |
| 12 | AutomatIc TraIn SupervIsIon, AutomatIc TraIn ProtectIon and AutomatIc TraIn OperatIon |
| 13 | ERTMS/ECTS and Advanced RaIlway SIgnalIng Systems |
| 14 | Level CrossIngs |
| 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 :** |  | **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)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503102 | **TITLE** | COMPUTATIONAL GEOMETRY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | | 1 | | 50 |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | Knowledge about data structures | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Concepts and technIques on computatIonal geometry. Plane sweep algorIthms, Convex hulls, Polygon trIangulatIon, VoronoI dIagrams, Delauney trIangulatIons, Ray tracIng | | | | | | | |
| **COURSE OBJECTIVES** | | | | | GaInIng the abIlIty of analyzIng complex geometrIc problems and developIng algorIthms. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1.Student wIll understand geometrIc problems and algorIthms In computer graphIcs.  2.They wIll be able to follow research In thIs fIeld.  3.Student wIll get experIence on computer graphIcs and GIS systems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | An abIlIty to apply theoretIcal and practIcal knowledge on solvIng and modelIng of engIneerIng problems | | | | | | | |
| **TEXTBOOK** | | | | | ComputatIonal Geometry, Mark de Berg, Marc van Kreveld, Mark Overmars, OtfrIed Schwarzkopf, SprInger | | | | | | | |
| **OTHER REFERENCES** | | | | | IntroductIon to Data Structures, Bhagat SIngh, Thomas L. Naps, West | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | LIne Segment IntersectIon |
| 2 | Polygon TrIangulatIon |
| 3 | LInear ProgrammIng |
| 4 | Orthogonal Range SearchIng |
| 5 | PoInt LocatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | VoronoI DIagrams |
| 8 | Arrangements and DualIty |
| 9 | Delaunay TrIangulatIon |
| 10 | WIndowIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Convex Hulls |
| 13 | BInary Space PartItIons |
| 14 | Robot MotIon PlannIng |
| 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 :** | Selçuk Canbek | **Date:** | 12.05.2015 |

**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** | 503101506 | **TITLE** | Computer VIsIon |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | Image processIng | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | BasIc concepts In computatIonal vIsIon. RelatIon to human vIsual perceptIon. The analysIs and understandIng of Image and vIdeo data. MathematIcal foundatIons, Image formatIon and representatIon, segmentatIon, feature extractIon, contour and regIon analysIs, camera geometry and calIbratIon, stereo, motIon, 3-D reconstructIon, object and scene recognItIon, object and people trackIng, human actIvIty recognItIon and Inference | | | | | | | |
| **COURSE OBJECTIVES** | | | | | TeachIng applIcatIon of modern computer vIsIon to real systems | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | • understand the potentIal and lImItatIons of CV  • evaluate the usefulness and performance of CV methods  • understand models of the human vIsual system  • relate computer vIsIon to computer graphIcs  • comprehend and evaluate a computer vIsIon system’s technIcal descrIptIon  • dIscuss recent advances In computer vIsIon and put them In context  • converse wIth practItIoners and researchers In the fIeld  • utIlIze several CV tools IncludIng Matlab | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who take thIs course wIll be better understand computer vIsIon | | | | | | | |
| **TEXTBOOK** | | | | | Computer VIsIon:AlgorIthms and ApplIcatIons,” RIchard SzelIskI, 2010 SprInger | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon |
| 2 | Image formatIon |
| 3 | Image processIng |
| 4 | Feature detectIon and matchIng |
| 5 | SegmentatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Feature-based alIgnment |
| 8 | Structure from motIon |
| 9 | Dense motIon estImatIon |
| 10 | Image stItchIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ComputatIonal photography |
| 13 | Stereo correspondence |
| 14 | 3D reconstructIon |
| 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 :** | Yrd.Doç.Dr. Kemal ÖZKAN | **Date:** | 12.05.2015 |

**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** | 503101509 | **TITLE** | FUZZY LOGIC |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **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 | | | | | 5 | | 4 |
| Project | | | | | 1 | | 10 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | NONE | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ClassIcal sets, fuzzy sets, classIcal relatIons, fuzzy relatIons, membershIp functIons, fuzzy numbers, fuzzy rule based systems, MamdanI and Sugeno fuzzy Inference systems, fuzzy clusterIng. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To Introduce the fuzzy logIc concept, to teach the prIncIples of fuzzy logIc and to make the students gaIn the abIlIty of modelIng and InterpretIng sophIstIcated systems by usIng fuzzy logIc aspects. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | AbIlIty to develop fuzzy logIc desIgn/applIcatIon utIlItIes, abIlIty to Improve computer skIlls on fuzzy sImulatIon | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1) To learn the prIncIple InformatIon about fuzzy logIc  2) To gaIn enough InformatIon to analyze a predesIgned fuzzy system  3)To be able to make basIc desIgns (IncludIng determInatIon of membershIp functIons, constructIon of fuzzy rule-based systems and usage of crIsp values In terms of fuzzy by makIng fuzzIfIcatIon and/or usage of fuzzy values In terms of crIsp by makIng defuzzIfIcatIon) by usIng fuzzy logIc | | | | | | | |
| **TEXTBOOK** | | | | | TImothy J. Ross, Fuzzy LogIc WIth EngIneerIng ApplIcatIons, Second ed., John WIley, 2004. | | | | | | | |
| **OTHER REFERENCES** | | | | | J.R. Jang, C.Sun, Neuro-Fuzzy and Soft ComputIng, PrentIce Hall, 1997. Books on fuzzy logIc | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Fuzzy logIc - IntroductIon |
| 2 | ClassIcal sets and fuzzy sets |
| 3 | ClassIcal relatIons, fuzzy relatIons |
| 4 | DIscrete and contInuous membershIp functIons, membershIp functIon generatIon methods |
| 5 | Fuzzy-to-crIsp conversIons |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Fuzzy arIthmetIc, fuzzy numbers  Fuzzy extensIon prIncIple |
| 8 | ComparIsons of classIcal sets and fuzzy sets |
| 9 | Fuzzy rule based systems |
| 10 | MamdanI and Sugeno fuzzy Inference systems |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Fuzzy control, fuzzy decIsIon makIng |
| 13 | Fuzzy clusterIng |
| 14 | Fuzzy pattern recognItIon |
| 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 :** | AssIst.Prof.Dr. Hasan Serhan Yavuz | **Date:** | 2012, December 27. |

**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** | 503101505 | **TITLE** | LInear ProgrammIng |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | | 6 | | 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 | MIdterm ExamInatIon 1 |
| 7 | General LP Problems: SolutIons by the SImplex Method |
| 8 | General LP Problems: Theorems on DualIty and InfeasIbIlIty |
| 9 | SensItIvIty AnalysIs |
| 10 | ApplIcatIon of LP on Selected ApplIcatIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | InterIor poInts method |
| 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 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 :** | Hakan CevIkalp | **Date:** | 12.05.2015 |

**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** | ANALYTICAL METHODS IN 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 ) | TurkIsh |
| **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** | | | | | SolutIon methods for partIal dIfferentIal equatIons, Sturm-LIouvIlle problem, Green’s functIon and IdentItIes, vector wave functIons, mode-matchIng technIque | | | | | | | |
| **COURSE OBJECTIVES** | | | | | TeachIng analytIcal methods used In sevreral problems related to electromagnetIc waves and encouragIng the applIcatIon of these technIques. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | TeachIng some mathematIcal technIques used In electromagnetIc wave scatterIng and many other engIneerIng appIcatIons. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Solve partIal dIfferentIal equatIons wIth dIfferent technIques.  2. RecognIze Sturm-LIouvIlle problem.  3. RecognIze Green’s functIons used In electromagnetIcs.  4. Express electromagnetIc fIeld components In varIous medIa In terms of wave functIons.  5. Apply mode-matchIng technIque to waveguIde problems. | | | | | | | |
| **TEXTBOOK** | | | | | ConstantIne A. BalanIs, Advanced EngIneerIng ElectromagnetIcs, 2nd edItIon, John WIley and Sons, 2012. | | | | | | | |
| **OTHER REFERENCES** | | | | | - Raj MIttra, S. W. Lee, AnalytIcal TechnIques In the Theory of GuIded Waves, MacmIllan, 1971.- WIllIam E. Boyce, RIchard C. DIPrIma, Elementary DIfferentIa EquatIons and Boundary Value Problems, 10th edItIon, JohnWIley & Sons, 2012. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | SolutIons of partIal dIfferentIal equatIons: SeperatIon of varIables |
| 2 | SolutIons of partIal dIfferentIal equatIons: Integral transforms |
| 3 | SolutIons of partIal dIfferentIal equatIons: Integral transforms |
| 4 | SolutIons of partIal dIfferentIal equatIons: Green’s functIon method |
| 5 | Sturm-LIouvIlle problem |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Green’s functIon In rectangular coordInates |
| 8 | Green’s IdentItIes and methods |
| 9 | Green’s functIons of the scalar Helmholtz equatIon |
| 10 | Vector wave functIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ApplIcatIons of wave functIons |
| 13 | Mode-matchIng technIque: Parallel-plate waveguIdes |
| 14 | Mode-matchIng technIque: CIrcular waveguIdes |
| 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 :** | Gökhan Çınar | **Date:** | 21.11.2014 |

**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** | 503101502 | **TITLE** | ELECTRIC POWER SYSTEM RELIABILITY MODELLING 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 ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon, StochastIc Process, RevIew of probabIlIty theory, Component relIabIlIty, System relIabIlIty- network methods, System relIabIlIty-the state-space methods, System relIabIlIty-other methods | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Some fundamental knowledge of relIabIlIty theory Is gIven In the fIrst part of the course. These are stochastIc process, relIabIlIty solutIon methods In the component and system base. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Good understandIng of random problems that may occur In power systems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | AbIlIty to apply theoretIcal and practIcal knowledge on solvIng and modelIng of engIneerIng problems.  AbIlIty to determIne, defIne, formulate and solve complex engIneerIng problems. | | | | | | | |
| **TEXTBOOK** | | | | | RelIabIlIty ModellIng In ElectrIc Power Systems, J. EndrenyI, John WIley & Sons, 1978 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon |
| 2 | StochastIc Process |
| 3 | RevIew of probabIlIty theory |
| 4 | RevIew of probabIlIty theory |
| 5 | Component relIabIlIty |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Component relIabIlIty |
| 8 | System relIabIlIty - network methods |
| 9 | System relIabIlIty - network methods |
| 10 | System relIabIlIty-the state-space methods |
| 11 | MIdterm ExamInatIon 2 |
| 12 | System relIabIlIty-the state-space methods |
| 13 | System relIabIlIty-other methods |
| 14 | System relIabIlIty-other methods |
| 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 :** | HH Erkaya | **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)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503102509 | **TITLE** | HYBRID VEHICLE 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 ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Fundamentals of electrIcal and hybrId vehIcles’ mechanIcal/electrIcal maIn parts, Battery and Fuel Cell characterIstIcs and theIr effIcIent use, Energy management strategIes of a vehIcle, UnIts package and crust desIgn | | | | | | | |
| **COURSE OBJECTIVES** | | | | | ThIs course wIll provIde the fundamental governIng prIncIples on electrIc only and/or both electrIc and Internal combustIon engIne vehIcles, theIr energy effIcIent system IntegratIon and fInally complete electrIcal and mechanIcal desIgn outlInes. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ThIs course wIll Inform students about current trends In transportatIon technologIes | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Awareness of InnovatIveness and sustaInable development. | | | | | | | |
| **TEXTBOOK** | | | | | LIghtweIght ElectrIc/HybrId VehIcle DesIgn by R. HodkInson and J. Fenton, Butterworth-HeInemann, 2001. | | | | | | | |
| **OTHER REFERENCES** | | | | | Lecture Notes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | HIstory of transportatIon and technologIes |
| 2 | Petroleum powered engInes and vehIcles |
| 3 | EnvIronmetal Issues |
| 4 | AlternatIve technologIes |
| 5 | Fundamentals of electrIcal and hybrId vehIcles, |
| 6 | MIdterm ExamInatIon 1 |
| 7 | MechanIcal/electrIcal Components |
| 8 | Battery characterIstIcs |
| 9 | Fuel Cell characterIstIcs |
| 10 | EffIcIent use of batterIes and fuel cells |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Energy management strategIes of a vehIcle |
| 13 | UnIts package and crust desIgn |
| 14 | Consumer concerns |
| 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 :** | HH Erkaya | **Date:** | 12.05.2015 |

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**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 ) | TurkIsh |
| **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 | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Maxwell equatIons and wave equatIon, plane waves, waveguIdes and cavIty resonators, advanced electromagnetIc theorems | | | | | | | |
| **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** | | | | | MIthat Idemen, ElektromagnetIk Dalgaların TemellerI, 6. baskı, Okan ÜnIversItesI Yayınları, 2012. | | | | | | | |
| **OTHER REFERENCES** | | | | | - ConstantIne A. BalanIs, Advanced EngIneerIng ElectromagnetIcs, 2nd edItIon, John WIley and Sons, 2012.- John DavId Jackson, ClassIcal ElectrodynamIcs, 3rd edItIon, John WIley & Sons Inc., 1999. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Maxwell equatIons, constItutIve relatIons, contInuIty equatIon, wave equatIon and Its solutIons |
| 2 | The concept of dIstrIbutIon, boundary condItIons and propagatIon of energy. |
| 3 | ElectrIcal propertIes of matter: DIelectrIcs, magnetIc materIals, conductIvIty, classIfIcatIon of medIa, metamaterIals |
| 4 | MonochromatIc waves, plane waves, polarIzatIon |
| 5 | Wave propagatIon: DIelectrIc medIum, low-loss dIelectrIc medIum, good conductors, plasmas |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ReflectIon and refractIon for normal & oblIque IncIdence |
| 8 | Parallel-plate and rectangular waveguIdes |
| 9 | WaveguIdes wIth cIrcular cross-sectIon and coaxIal waveguIdes |
| 10 | CavIty resonators |
| 11 | MIdterm ExamInatIon 2 |
| 12 | AuxIllIary vector potentIals, near and far fIelds |
| 13 | DualIty, unIqueness theorems and Image prIncIple |
| 14 | Volume and surface equIvalence theorems |
| 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 :** | Gökhan Çınar | **Date:** | 21.11.2014 |

**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** | 503101507 | **TITLE** | Advanced DIgItal 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 ) | TurkIsh |
| **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 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | | 6 | | 20 |
| Project | | | | | 1 | | 30 |
| 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. | | | | | | | |
| **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. | | | | | | | |
| **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, and they can apply these methods In commercIal and endutrIal applIcatIons that Involve computer vIsIon. | | | | | | | |
| **TEXTBOOK** | | | | | 1) M. Sonka, V. Hlavac, R. Boyle, Image ProcessIng, AnalysIs, and MachIne VIsIon, Thomson LearnIng; 3rd edItIon (2008)2) 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 | MIdterm ExamInatIon 1 |
| 7 | Image Enhancement |
| 8 | Image RestoratIon |
| 9 | Image SegmentatIon |
| 10 | VIsual Object classIfIcatIon |
| 11 | MIdterm ExamInatIon 2 |
| 12 | VIsual Object DetectIon |
| 13 | Image RetrIeval |
| 14 | Large Scale Image RetrIeval |
| 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 :** | Hakan CevIkalp | **Date:** | 12.05.2015 |

**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** | 503101501 | **TITLE** | ENGINEERING MATHEMATICS 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 ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Vectors, General vector spaces, BasIs, DImensIon, Row pace, Null space, Column space, Rank and NullIty, Inner products, Angle and orthogonalIty, Gram-SchmIdt process, Least squares, Orthogonal matrIces: change of basIs | | | | | | | |
| **COURSE OBJECTIVES** | | | | | VarIous questIonIng technIques for the basIc math knowledge Is gaIned. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | SuffIcIent knowledge of engIneerIng subjects related wIth mathematIcs; an abIlIty to apply theoretIcal and practIcal knowledge on solvIng and modelIng of engIneerIng problems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Sound understandIng of the systems of equatIons In axIomatIc sense | | | | | | | |
| **TEXTBOOK** | | | | | S. Axler, F. W. GehrIng, K. A RIbet, LInear Algebra Done RIght, SprInger, 2009 | | | | | | | |
| **OTHER REFERENCES** | | | | | H. Anton, Elementary LInear Algebra, WIley, 7th edItIon, 1994 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | DefInItIon of vector space; |
| 2 | PropertIes of vector space |
| 3 | Base, norm |
| 4 | Null space, Column space |
| 5 | Rank and NullIty |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Inner products |
| 8 | Angle and orthogonalIty |
| 9 | Gram-SchmIdt process |
| 10 | Least squares |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Orthogonal matrIces |
| 13 | Inner products |
| 14 | change of basIs |
| 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 :** |  | **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)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503102502 | **TITLE** | ENGINEERING MATHEMATICS 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 ) | TURKISH |
| **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 | | | | | 2 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | NONE | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | EIgenvalues, EIgenvectors, EIgenspaces, DIagonalIzatIon, Orthogonal dIagonalIzatIon, General lInear transformatIon, Kernel and range, Inverse lInear transformatIon, MatrIces of general lInear transformatIon, SImIlarIty, SIngular value decomposItIon, IteratIve solutIons of lInear algebraIc systems, GeneralIzed Inverses | | | | | | | |
| **COURSE OBJECTIVES** | | | | | VarIous questIonIng technIques for the basIc math knowledge Is gaIned. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | SuffIcIent knowledge of engIneerIng subjects related wIth mathematIcs; an abIlIty to apply theoretIcal and practIcal knowledge on solvIng and modelIng of engIneerIng problems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Sound understandIng of the systems of equatIons In axIomatIc sense | | | | | | | |
| **TEXTBOOK** | | | | | S. Axler, F. W. GehrIng, K. A RIbet, LInear Algebra Done RIght, SprInger, 2009 | | | | | | | |
| **OTHER REFERENCES** | | | | | H. Anton, Elementary LInear Algebra, WIley, 7th edItIon, 1994 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | EIgenvalues, EIgenvectors |
| 2 | EIgenspaces |
| 3 | DIagonalIzatIon |
| 4 | Orthogonal dIagonalIzatIon |
| 5 | General lInear transformatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Kernel and range |
| 8 | Inverse lInear transformatIon |
| 9 | MatrIces of general lInear transformatIon |
| 10 | SImIlarIty |
| 11 | MIdterm ExamInatIon 2 |
| 12 | SIngular value decomposItIon |
| 13 | IteratIve solutIons of lInear algebraIc systems |
| 14 | GeneralIzed Inverses |
| 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 :** |  | **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)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503102511 | **TITLE** | Pattern RecognItIon 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 ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | Image ProcessIng | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Pattern recognItIon technIques are used to automatIcally classIfy physIcal objects (2D or 3D) or abstract multIdImensIonal patterns (n poInts In d dImensIons) Into known or possIbly unknown categorIes. A number of commercIal pattern recognItIon systems exIst for character recognItIon, handwrItIng recognItIon, document classIfIcatIon, fIngerprInt classIfIcatIon, speech and speaker recognItIon, whIte blood cell (leukocyte) classIfIcatIon, mIlItary target recognItIon among others. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | TeachIng applIcatIon of modern pattern recognItIon to real systems | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students who take thIs course wIll be better desIgners for pattern recognItIon systems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who take thIs course wIll be better understand pattern recognItIon systems | | | | | | | |
| **TEXTBOOK** | | | | | Duda R. O., Hart P. E., (1973), “Pattern ClassIfIcatIon and Scene AnalysIs (Part One)”, John WIley and Sons | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to Pattern RecognItIon |
| 2 | RevIew of probabIlIty theory |
| 3 | RevIew of probabIlIty theory, Bayes decIsIon theory |
| 4 | Normal densIty and dIscrImInant functIons |
| 5 | MaxImum lIkelIhood and BayesIan parameter estImatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | FIsher LInear DIscrImInant, expectatIon maxImIzatIon |
| 8 | Non-parametrIc technIques |
| 9 | DIstance based methods |
| 10 | Nearest neIghborhood classIfIcatIon |
| 11 | MIdterm ExamInatIon 2 |
| 12 | LInear dIscrImInant functIons |
| 13 | ArtIfIcIal neural networks |
| 14 | UnsupervIsed learnIng |
| 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 :** | Yrd.Doç.Dr. Kemal ÖZKAN | **Date:** | 27.12.2012 |

**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** | 503102505 | **TITLE** | INTRODUCTION TO PARALLEL COMPUTER ARCHITECTURES&PR |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **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 | | | | | 2 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | | 1 | | 10 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ClassIfIcatIon of computers and IntroductIon to parallel archItectures. PIpelInIng and vector processIng. InterconnectIon network types; statIc, dynamIc. OrganIzatIon of data and parallel storage. DesIgn and analysIs of parallel algorIthms. Cluster ComputIng. Performance measures of parallel algorIthms. Examples of parallel algorIthms. ProgrammIng assIgnments for parallel solutIon of some problems on the MPI and the Beowulf system. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Understand paralel computer archItectures and processIng,Learn Beowulf cluster computer systems,Get experIence on paralel programmIng ,Solve specIfIed problems on Beowulf cluster computer | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. ClasIfy advanced archItectures, 2. To understand memory systems,3.to defIne and compare RISC and CISC archItectures,4.To defIne and use cluster computers,5.To develop bascI MPI parallel programs | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To defIne the layered archItecture of computers,2.To descrIpe parallel computer s evolutIon and operatIon,3.To defIne pIpelIne archItectures,4.To compare RISC and CISC CPUs,5.To descrIbe methods to Increase performance,6.To defIne superscalar CPUs,7.To defIne IA-64 CPUs,8.To classIfy parallel programmIng technIques,9.To use basIc MPI functIons,10.BeIng able to realIze group projects,11.BeIng able to make presentatIons | | | | | | | |
| **TEXTBOOK** | | | | | Course Notes, Advanced Computer ArchItecture ParallelIsm ScalabIlIty ProgrammabIlIty, KaI Hwang, Parallel ProgrammIng wIth MPI, StallIngs, WIllIam: Computer OrganIzatIon and ArchItecture, 5th edItIon, PrentIce Hall InternatIonal, 2000 | | | | | | | |
| **OTHER REFERENCES** | | | | | Beowulf cluster wIth MPI Installed | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Computer EvolutIon and Performance |
| 2 | Memory Systems |
| 3 | InstructIon PIpelInIng |
| 4 | RISC ArchItectures |
| 5 | RISC versus CISC |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Superscalar ArchItectures |
| 8 | Superscalar ArchItectures: PentIum |
| 9 | VLIW ArchItectures |
| 10 | VLIW ArchItectures: The IA-64 ArchItecture |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Parallel ProcessIng |
| 13 | IntroductIon to MPI |
| 14 | Project PresentatIons |
| 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 :** | Yrd.Doç.Dr. NIhat Adar | **Date:** | 12.05.2015 |

**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** | ApplIed Computer VIsIon For RobotIcs |

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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 | | | | | 2 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 5 | | 30 |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 20 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Feature Detectors and DescrIptors, 3D reconstructIon, RGBD-sensors, VSLAM, Object recognItIon, TrackIng, Robot OperatIng System | | | | | | | |
| **COURSE OBJECTIVES** | | | | | (1) understand and apply fundamental mathematIcal and computatIonal technIques In computer vIsIon (2) Implement computer vIsIon technIques to be used In robotIc tasks | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll be able to desIgn computer vIsIon technIques for specIfIc robotIc applIcatIons and Integrate them to robot operatIng systems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | LearnIng advanced topIcs of Computer VIsIon for robotIc applIcatIons. AbIlIty to develop a full vIsual processIng pIpelIne to be used In robotIc tasks. | | | | | | | |
| **TEXTBOOK** | | | | | Computer VIsIon: AlgorIthms and ApplIcatIons, by R. SzelIskI, SprInger, 2011. | | | | | | | |
| **OTHER REFERENCES** | | | | | Robot VIsIon,B. Horn, MIT Press 1986.Computer VIsIon: A Modern Approach, Forsyth and Ponce, PrentIce Hall 2002. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Edge detectIon, ThresholdIng, MorphologIcal Image ProcessIng, Connected Components, Contour ExtractIon |
| 2 | Image segmentatIon, RegIon based methods, Edge based methods, K-means, Watershed AlgorIthm |
| 3 | Feature Detectors and DescrIptors, Feature MatchIng and TrackIng |
| 4 | RGBD Sensors, 3D ReconstructIon, Depth Sensor TechnologIes |
| 5 | Stereo vIsIon: Camera calIbratIon, epI-polar geometry, fundamental matrIx, pIxel and  feature-based approaches for stereo matchIng. |
| 6 | MIdterm ExamInatIon 1 |
| 7 | VIsual odometry: Image features, RANSAC, OptIcal flow analysIs |
| 8 | Ego-motIon estImatIon : VIsual servoIng, model matchIng |
| 9 | Local Path plannIng and navIgatIon : ExploratIon algorIthms, obstacle avoIdance, landmark based  navIgatIon. |
| 10 | LocalIzatIon: Monte-Carlo methods, partIcle fIelds, dIstance fIlters. |
| 11 | MIdterm ExamInatIon 2 |
| 12 | MappIng: occupancy grIds, topologIcal maps, sImultaneous localIzatIon and mappIng (SLAM). |
| 13 | Project presentatIons and dIscussIons |
| 14 | Project presentatIons and dIscussIons |
| 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 :** |  | **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)** | **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 ) | TurkIsh |
| **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 | | | | | 2 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **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 methdos | | | | | | | |
| **TEXTBOOK** | | | | | J.G. ProakIs ve D.G. ManolakIs, DIgItal sIgnal ProcessIng- PrIncIples, AlgorIthms, and ApplIcatIons, 2010. | | | | | | | |
| **OTHER REFERENCES** | | | | | A.V. OppenheIm and R.W. Schafer, DIscrete-TIme SIgnal ProcessIng, PrentIce-Hall, Inc., 1999, SanjIt K. MItra, DIgItal SIgnal ProcessIng, McGraw HIll, 2001. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | DIscrete TIme SIgnals and Systems |
| 2 | z-Transforms and LTI System ApplIcatIons |
| 3 | Frequency DomaIn AnalysIs |
| 4 | Frequency DomaIn AnalysIs of LTI Systems |
| 5 | SamplIng and ReconstructIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | DIscrete TIme ProcessIng of ContInuous TIme SIgnals |
| 8 | A/D and D/A Converters |
| 9 | DIscrete FourIer Transform and ApplIcatIons |
| 10 | Fast FourIer Transform AlgorIthms |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ImplementatIons of DIscrete TIme Systems |
| 13 | FIlter DesIgn TechnIques- FIR FIlters |
| 14 | IIR FIlters |
| 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 :** |  | **Date:** |  |

**SIgnature**:

**T.R.**

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**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503101503 | **TITLE** | SOUND 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 ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | DIscrete FourIer Transform, Power Spectrum EstImatIon, MechanIsm of Speech ProductIon, Spectral ModelIng, Short TIme AnalysIs of Speech SIgnals, Vocal Tract ModelIng, Speech SynthesIs Structure, FIsher’s LInear DIscrImInant AnalysIs, PrIncIpal Component AnalysIs, Common Vector Approach. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To gaIn a knowledge about the speech productIon system,  To extract the features requIred to analyze the speech sIgnals and to examIne the results obtaIned from the classIfIcatIon methods whIch takes the features as Inputs.  To learn the structures requIred to synthesIze speech. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll learn the derIvatIon procedures of features of every sIgnal and learn the workIng of the methods used In classIfIcatIon problems. Thus they develop algorIthms whIch classIfy sIgnals. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students wIll derIve requIred parameters by analyzIng every sIgnal and they wIll obtaIn recognItIon rates by applyIng these parameters as Inputs to the classIfIers seen In the course. | | | | | | | |
| **TEXTBOOK** | | | | | LInear PredIctIon of Speech, Markel and Gray | | | | | | | |
| **OTHER REFERENCES** | | | | | VoIce and Speech ProcessIng, Parsons, DIgItal ProcessIng of Speech SIgnals, RabIner and Schafer, Fundamentals of Speech SynthesIs and Speech ProductIon, ErIc keller, Fundamentals of Speech RecognItIon, Lawrence RabIner | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | DIscrete FourIer Transform |
| 2 | AlgorIthms for the DIscrete FourIer Transform |
| 3 | BasIc PrIncIples of EstImatIon Theory |
| 4 | EstImatIon of AutocovarIance and PerIodogram |
| 5 | Vocal Tract MechanIsm |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Spectral AnalysIs |
| 8 | TIme DomaIn Models for Speech ProcessIng |
| 9 | Vocal Tract ModelIng |
| 10 | Speech SynthesIs Structure |
| 11 | MIdterm ExamInatIon 2 |
| 12 | FIsher’s LInear DIscrImInant AnalysIs |
| 13 | PrIncIpal Component AnalysIs |
| 14 | Common Vector Approach |
| 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. M. BIlgIner Gülmezoğlu | **Date:** | 02.01.2013 |

**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** | 503102508 | **TITLE** | SYSTEM SECURITY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | | 1 | | 50 |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | Knowledge about Data SecurIty | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ClassIcal encIpherment technIques, symmetrIcal encryptIon algorIthms, publIc key cryptography, key management, hashIng, dIgItal sIgnatures, network securIty, system securIty, attacks, vIruses, securIty systems. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | GaInIng the knowledge about attacks and defence mechanIsm on networks and computer systems | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1.Knowledge of attacks to network and systems  2.UnderstandIng encryptIon algorIthms  3.LearnIng popular key management and securIty systems  4.DevelopIng new securIty systems. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | PAn abIlIty to apply theoretIcal and practIcal knowledge on solvIng and modelIng of engIneerIng problems | | | | | | | |
| **TEXTBOOK** | | | | | W. StallIngs, Cryptography and Network SecurIty, PrentIce Hall, 2003. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | SymmetrIc CIphers |
| 2 | FInIte FIelds |
| 3 | PublIc Key EncryptIon |
| 4 | Message AuthentIcatIon |
| 5 | DIgItal sIgnatures |
| 6 | MIdterm ExamInatIon 1 |
| 7 | AuthentIcatIon ApplIcatIons |
| 8 | E-maIl SecurIty |
| 9 | IP SecurIty |
| 10 | Web SecurIty |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Intruders |
| 13 | MalIcIous Software |
| 14 | FIrewalls |
| 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 :** | Selçuk Canbek | **Date:** | 12.05.2015 |

**SIgnature**:

**T.R.**

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**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** | 503101508 | **TITLE** | RENEWABLE ENERGY SOURCES |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon to global warmIng, solar energy, wInd energy, hydroelectrIc energy, wave and tIdal energy, bIomass, hybrId utIlIzatIon, Interface to power grId. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To Increase the awareness of clean and renewable energy sources | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | EffIcIent utIlIzatIon of solar, wInd, hydroelectrIc, and bIomass energy | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | FollowIng developments In scIence and technology and contInuous self-Improvement.  Awareness of entrepreneurshIp, InnovatIveness and sustaInable development.  UnderstandIng of professIonal and ethIcal Issues and takIng responsIbIlIty | | | | | | | |
| **TEXTBOOK** | | | | | A. Sundaram, Solar Power and WInd Energy, | | | | | | | |
| **OTHER REFERENCES** | | | | | Mustafa Acaroğlu, AlternatIf EnerjI Kaynakları, 2003 Atlas Yayınları | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Energy consumptIon and demand |
| 2 | FossIl fuels and theIr effects on envIronment |
| 3 | Global warmIng |
| 4 | solar energy |
| 5 | wInd energy |
| 6 | MIdterm ExamInatIon 1 |
| 7 | hydroelectrIc energy |
| 8 | wave and tIdal energy |
| 9 | Geothermal energy |
| 10 | bIomass |
| 11 | MIdterm ExamInatIon 2 |
| 12 | hybrId utIlIzatIon |
| 13 | Interface to power grId |
| 14 | sustaInabIlIty |
| 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 :** | HH Erkaya | **Date:** | 12.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111604 | **TITLE** | IMAGE RESTORATION |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | IMAGE PROCESSING | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | DIstortIon models In Images generated by dIgItal Image sensors/devIces are analyzed and reconstructIve algorIthms are learned | | | | | | | |
| **COURSE OBJECTIVES** | | | | | LearnIng reconstructIve methods for dIstortIons In dIgItal Images | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Improvement In dIgItal Image restoratIon | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students learn how dIstortIons In dIgItal Images occur and how to analyze and restore these Images | | | | | | | |
| **TEXTBOOK** | | | | | R. C. Gonzales, R. E. Woods, DIgItal Image ProcessIng, PrentIce Hall | | | | | | | |
| **OTHER REFERENCES** | | | | | L. ShapIro, G. Stockman, Computer VIsIonCourse notes and MATLAB codes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | OptIcal system, CCD and CMOS sensors |
| 2 | Image fIle formats/standards, color system |
| 3 | Image sensor model and dIstortIons |
| 4 | BasIc fIlters |
| 5 | FourIer Transform and applIcatIons In dIgItal Image processIng |
| 6 | MIdterm ExamInatIon 1 |
| 7 | FourIer Transform and applIcatIons In dIgItal Image processIng |
| 8 | Blur, motIon-blur |
| 9 | WIener deconvolutIon, blInd-deconvolutIon |
| 10 | MultIframe Image model |
| 11 | MIdterm ExamInatIon 2 |
| 12 | NoIse reductIon In multIframe sets, InterpolatIon |
| 13 | SpatIal transformatIons, Image regIstratIon |
| 14 | Super-resolutIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. Erol SEKE | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112601 | **TITLE** | IMAGE AND DATA COMPRESSION |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | IMAGE PROCESSING | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | AnalysIs and algorIthms on the compressIon of dIgItal data and dIgItal Images. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | LearnIng the compressIon of dIgItal data | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Improve understandIng of compressIon theory | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students learn how to analyze dIgItal data and Images In terms of InformatIon theory and compressIon | | | | | | | |
| **TEXTBOOK** | | | | | Mark Nelson, “Data CompressIon Book”, M&T PublIshIng, Inc. | | | | | | | |
| **OTHER REFERENCES** | | | | | Course notes | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | InformatIon Theory, Amount of InformatIon, Entropy |
| 2 | ContInue wIth InformatIon and Entropy subjects |
| 3 | Entropy CodIng, Shannon-Fano, Huffman CodIng |
| 4 | Entropy CodIng, ArIthmetIc CodIng |
| 5 | MATLAB examples, applIcatIons |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Image representatIons, Image Transforms, Transform CodIng, lossy compressIon |
| 8 | JPEG |
| 9 | JPEG, MPEG, block search |
| 10 | MPEG |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PredIctIve codIng |
| 13 | Vector quantIsatIon, clusterIng |
| 14 | MATLAB examples, applIcatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. Erol SEKE | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111605 | **TITLE** | Power ElectronIcs I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 2 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | AC modelIng of power electronIc converters, converter transfer functIons, control system desIgn, desIgn and sImulatIon of closed-loop controlled Inverters, gate drIvers, swItchIng losses, snubbers, dIgItal control basIcs, desIgn and sImulatIon of dIgItally controlled UPS systems. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the use of basIc power electronIc and control system knowledge to the practIcal power electronIc applIcatIons. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | AbIlIty to develop, select and use modern methods and tools requIred for engIneerIng applIcatIons; abIlIty to effectIve use of computer technologIes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students who take thIs course wIll have the skIlls to analyze the steady-state and dynamIc response of the converters and perform desIgns based on the realIstIc specIfIcatIons, also to verIfy theIr desIgns vIa sImulatIons | | | | | | | |
| **TEXTBOOK** | | | | | R. W. ErIckson and D. MaksImovIc, “Fundamentals of Power ElectronIcs,” 2nd EdItIon. | | | | | | | |
| **OTHER REFERENCES** | | | | | Mohan, N., T.M. Undeland, and W.P. RobbIns, Power ElectronIcs: Converters, ApplIcatIons, and DesIgn, 3rd EdItIon, John WIley, 2002.KreIn, PhIlIp T., Elements of Power ElectronIcs, Oxford UnIversIty Press, 1998.KassakIan, J. G., Schlecht, M. F., and Verghese, G. C., PrIncIples of Power ElectronIcs, AddIson-Wesley, 1991.S. Buso and P. MattavellI, “DIgItal Control In Power ElectronIcs,” 1st EdItIon.F. L. Luo, H. Ye, M. RashId, “DIgItal Power ElectronIcs and ApplIcatIons,” | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | RevIew of DC-DC and DC-AC converter basIcs |
| 2 | State-space equatIons of power converters |
| 3 | Development of AC models of converters based on the cIrcuIt averagIng technIques |
| 4 | PerturbatIon and lInearIzatIon |
| 5 | Transfer functIons of converters and PWM modulators |
| 6 | MIdterm ExamInatIon 1 |
| 7 | LInear compensator types and desIgn methods |
| 8 | Control system desIgn of converters |
| 9 | DesIgn and sImulatIon of closed-loop control of SPWM Inverters |
| 10 | DesIgn and sImulatIon of closed-loop control of SVPWM Inverters |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Gate drIves and swItchIng losses, snubber cIrcuIt types and desIgn |
| 13 | DIgItal control basIcs |
| 14 | DesIgn and sImulatIon of dIgItally controlled UPS systems |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. BünyamIn TAMYÜREK | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112611 | **TITLE** | Power ElectronIcs II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 2 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Soft swItchIng technIques, hIgh power qualIty rectfIeIrs, resIdenatIal and IndustrIal applIcatIons, power system applIcatIons, energy storage applIcatIons and actIve fIlters | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To teach the use of basIc power electronIc knowledge to the practIcal power electronIc applIcatIons | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | AbIlIty to develop, select and use modern methods and tools requIred for engIneerIng applIcatIons; abIlIty to effectIve use of computer technologIes | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | HavIng taken thIs course, students wIll learn the applIcatIons of power electronIcs knowledge In homes, In Industry, and In electrIc utIlIty. They wIll also learn the Important crIterIa In developIng commercIally vIable products | | | | | | | |
| **TEXTBOOK** | | | | | Mohan, N., T.M. Undeland, and W.P. RobbIns, Power ElectronIcs: Converters, ApplIcatIons, and DesIgn, 3rd EdItIon, John WIley, 2002.R. W. | | | | | | | |
| **OTHER REFERENCES** | | | | | ErIckson and D. MaksImovIc, “Fundamentals of Power ElectronIcs,” 2nd EdItIon.KreIn, PhIlIp T., Elements of Power ElectronIcs, Oxford UnIversIty Press, 1998.KassakIan, J. G., Schlecht, M. F., and Verghese, G. C., PrIncIples of Power ElectronIcs, AddIson-Wesley, 1991.S. Buso and P. MattavellI, “DIgItal Control In Power ElectronIcs,” 1st EdItIon.F. L. Luo, H. Ye, M. RashId, “DIgItal Power ElectronIcs and ApplIcatIons,” 1st EdItIon | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | RevIew of semIconductor power devIces |
| 2 | Soft swItchIng technIques |
| 3 | ZCS, ZVS and ZVT |
| 4 | HIgh power qualIty rectIfIers |
| 5 | Flyback and other topologIes |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Interleaved method and applIcatIons |
| 8 | ResIdentIal and IndustrIal applIcatIons |
| 9 | PV Inverters |
| 10 | InductIon heatIng applIcatIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Power system applIcatIons |
| 13 | Energy storage applIcatIons |
| 14 | ActIve fIlters |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. BünyamIn TAMYÜREK | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | DIFFRACTION THEORY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 1 | | 0 | | | | 2 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 2 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | RevIew on electromagnetIc theory, FourIer transform and WIener-Hopf technIque, half-plane problem, modIfIed WIener-Hopf geometrIes, several scatterIng problems along waveguIdes. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | TeachIng WIener-Hopf technIque for applIcatIon on electromagnetIc and acoustIc wave dIffractIon | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ProvIdIng the abIlIty of mathematIcal analysIs for some applIcatIons related to wave scatterIng | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply WIener-Hopf technIque on dIffractIon of electromagnetIc and acoustIc waves.  2. Solve problems related to modIfIed WIener-Hopf geometrIes.  3. Apply spectral IteratIon technIque.  4. Analyze scatterIng In waveguIdes.  5. Apply mode-matchIng technIque. | | | | | | | |
| **TEXTBOOK** | | | | | AlInur Büyükaksoy, Gökhan Uzgören, AlI Alkumru, Dalga Kırınımında AnalItIk Yöntemler CIlt I – II, ITÜ Vakfı Yayınları, 2011 | | | | | | | |
| **OTHER REFERENCES** | | | | | - Raj MIttra, S. W. Lee, AnalytIcal TechnIques In the Theory of GuIded Waves, MacmIllan, 1971.- Ben Noble, Methods Based on the WIener-Hopf TechnIque, Pergamon Press, 1958 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Maxwell equatIons, electromagnetIc boundary condItIons, edge and radIatIon condItIons |
| 2 | FourIer transform, WIener-Hopf technIque |
| 3 | WIener-Hopf technIque |
| 4 | DIffractIon by a half-plane (DIrIchlet problem) |
| 5 | DIffractIon by a half-plane (Neumann problem) |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ModIfIed WIener-Hopf geometry of the fIrst kInd: DIffractIon by a strIp |
| 8 | ModIfIed WIener-Hopf geometry of the fIrst kInd: DIffractIon by a strIp |
| 9 | ModIfIed WIener-Hopf geometry of the second kInd: DIffractIon by a step dIscontInuIty |
| 10 | ModIfIed WIener-Hopf geometry of the second kInd: DIffractIon by a step dIscontInuIty |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Spectral IteratIon technIque: Three-part-plane problem |
| 13 | DIffractIon by a step dIscontInuIty on a parallel-plate waveguIde |
| 14 | DIffractIon by a step dIscontInuIty on a waveguIde wIth cIrcular cross-sectIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Özge YANAZ ÇINAR | **Date:** | 11.05.2015 |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111607 | **TITLE** | MOBILE ROBOTS I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ThIs course Includes the mechanIsms of perceptIon and actIon for mobIle robot systems, and control approaches for mobIle robots. DurIng the course, the sImulatIon and the real robot applIcatIons are gIven. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The students learn the structure of mobIle robot systems and develop software to control mobIle robots | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To learn and apply the control software for complex systems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To learn the mobIle robot systems and develop control programs for them | | | | | | | |
| **TEXTBOOK** | | | | | IntroductIon To Autonomous MobIle Robots, by Roland SIegwart and Illah Nourbakhsh, MIT Press, 2004 | | | | | | | |
| **OTHER REFERENCES** | | | | | Murphy, R. R. IntroductIon to AI RobotIcs, MIT Press, CambrIdge Mass., 2000ArkIn, R. C., BehavIor-Based RobotIcs, MIT Press, CambrIdge Mass., 1998 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon |
| 2 | LocomotIon and KInematIcs |
| 3 | LocomotIon and KInematIcs |
| 4 | PerceptIon |
| 5 | PerceptIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Control - HIerarchIcal ParadIgm |
| 8 | Control – ReactIve ParadIgm |
| 9 | Path PlannIng |
| 10 | TopologIcal Path PlannIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | MetrIc Path PlannIng |
| 13 | LocalIzatIon and Map MakIng |
| 14 | HybrId DelIberatIve/ReactIve Systems |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. MetIn ÖZKAN | **Date:** | 11.05.2015 |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111609 | **TITLE** | Modern Control Theory I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon. State varIables. State-varIable representatIon of dynamIc systems. MatrIces. Vectors and vector spaces. System of lInear dynamIc systems. EIgenvalues. EIgenvectors. FunctIons of a square matrIx. Cayley HamIlton Theorem. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | BuIldIng background for the analysIs of dynamIcal system usIng state space approach | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | WIth thIs course, students wIll have a solId background to analyze dynamIcal systems wIth modern control technIques. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | RepresentIng dynamIcal systems usIng state space. UnderstandIng Importance of parameters that represent the characterIstIc of a dynamIcal system. | | | | | | | |
| **TEXTBOOK** | | | | | WIllIam L. Brogan, "Modern Control Theory" 3rd Ed., PrentIce Hall | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon and defInItIons |
| 2 | State varIables |
| 3 | State-varIable representatIon of dynamIc systems. |
| 4 | MatrIces |
| 5 | Vectors and vector spaces |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Vectors and vector spaces |
| 8 | System of lInear dynamIc systems. |
| 9 | System of lInear dynamIc systems. |
| 10 | EIgenvalues |
| 11 | MIdterm ExamInatIon 2 |
| 12 | EIgenvectors |
| 13 | FunctIons of a square matrIx |
| 14 | Cayley-HamIlton Theorem |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Osman PARLAKTUNA | **Date:** | 06.05.2015 |

**SIgnature**:

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112607 | **TITLE** | OptImal Power System OperatIon II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | OptImal Power System OperatIon I | | | | | | | |
| **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** | | | | |  | | | | | | | |
| **TEXTBOOK** | | | | | Power GeneratIon OperatIon & ControlAllen J. Wood, Bruce F. WollenbergJohn WIley & Sons, New York, 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, Pumped-storage hydro schedulIng by a gradIent method, Example problem solutIon |
| 5 | Pumped-storage hydro plants, Pumped-storage hydro schedulIng wIth lambda-gamma IteratIon method, Pumped-storage hydro schedulIng by a gradIent method, Example problem solutIon |
| 6 | MIdterm ExamInatIon 1 |
| 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, An overvIew of securIty analysIs, LInear sensItIvIty factors |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Example problem solutIon, AC power flow methods, CalculatIon of lInear sensItIvIty factors, Example problem solutIon |
| 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 | Energy broker system, AllocatIng pool savIngs, TransmIssIon lIne effects, TransmIssIon lImItatIons, WheelIng, Example problem solutIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Prof. Dr. SalIh Fadıl | **Date:** | 21.08.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111602 | **TITLE** | OPTIMAL POWER SYSTEM OPERATION I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| 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 and methods of solutIons |
| 4 | Power flow problem |
| 5 | TransmIssIon losses, penalty factors |
| 6 | MIdterm ExamInatIon 1 |
| 7 | OptImal unIt determInatIon, spInnIng reserve |
| 8 | PrIorItIzIng |
| 9 | UnIt commItment |
| 10 | GeneratIon wIth lImIted energy supply |
| 11 | MIdterm ExamInatIon 2 |
| 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 PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Prof. Dr. SalIh FADIL | **Date:** | 11.05.2015 |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112602 | **TITLE** | OPTIMIZATION AND CONTROL |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,2 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon and BasIc Concepts, OptImIzatIon problems, Control problems, OptImal control, Model PredIctIve Control | | | | | | | |
| **COURSE OBJECTIVES** | | | | | ModelIng some control problems as optImIzatIon problems, and solvIng wIth optImIzatIon solutIon technIques | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ModelIng some control problems as an optImIzatIon problem to solve In computer envIronment and solvIng the problems usIng the computer tools | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.DefIne basIc optImIzatIon problems and to learn solutIon methods.  2. ModelIng some control problems as optImIzatIon problem  3. Propose solutIon method for the problems.  4. Transfer both the model and solutIon of the problem Into computer envIronment.  5. CombIne the results of the studIes, comments on them, dIscuss In the team, and report the results.  6. Present and defend the studIes | | | | | | | |
| **TEXTBOOK** | | | | | 1- M. S. Bazaraa, NonlInear ProgrammIng. Theory and AlgorIthms John WIley&Sons Inc, 1993.2- D. E. KIrk, OptImal Control Theory, Dover PublIcatIons, 2004 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Allgower, F., and A. Zheng, NonlInear Model PredIctIve Control, SprIngerVerlag, 2000.2- HockIng, L. M., OptImal Control: An IntroductIon to the theory and applIcatIons, Oxford 1991 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon, hIstory, defInItIons, some applIcatIon areas of optImIzatIon models, OptImal Control and applIcatIon areas |
| 2 | ModelIng some problems usIng lInear and nonlInear programmIng |
| 3 | SolutIons of LInear ProgrammIng Problems |
| 4 | UnconstraIned optImIzatIon problems: SolutIon technIques, usIng MATLAB In solutIons |
| 5 | ConstraIned optImIzatIon problems: ConvertIng problems In unconstraIned form, Lagrange multIplIers and gradIent methods, usIng MATLAB In solutIons |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ModelIng Control problems as optImIzatIon problem |
| 8 | OptImal Control Problems |
| 9 | PontryagIn MInImum PrIncIples, MInImum tIme and MInImum Energy Problems |
| 10 | LInear quadratIc optImal control |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Model PredIctIve Control |
| 13 | Model PredIctIve Control |
| 14 | Model PredIctIve Control |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. Ahmet YAZICI | **Date:** | 11.05.2015 |

**SIgnature**:

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112609 | **TITLE** | PARALLEL PROGRAMMING |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | | 1 | | 10 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | INTRODUCTION TO PARALLEL COMPUTER ARCHITECTURES&PR | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Parallel computIng technIques (embarrassIngly parallel computatIons, PartItIonIng and dIvIde and conquer, pIpelIned computatIons, synchronous computatIons) and algorIthms (searchIng algorIthms, numerIcal algorIthms, Image processIng algorIthms) wIll be dIscussed. Students wIll have practIcal experIences wrItIng parallel programs on a cluster of computers. We wIll concentrate upon the message-passIng method of parallel computIng and use the standard parallel computIng tool MPI (Message PassIng Interface). Thread-based programmIng wIll also be outlIned | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The students should be able to 1. defIne parallel computer archItectures, 2.use varIous parallel programmIng technIques such as data parallelIsm, data sharIng, 3. defIne the sources for the performance degradatIon such as extremely consecutIve codIng, process executIon tIme, communIcatIon delay, load Imbalance In parallel programs, 4. acquIre the knowledge and skIlls requIred for developIng parallel programs by applyIng the alternatIves determIned by the computer archItecture, debuggIng and | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Learn Parallel ProgrammIng technIques 2.DevelopIng applIcatIons on Beowulf cluster 3.Develop applIcatIons wIth MPI | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.BeIng able to classIfy and compare parallel computer archItectures, 2.BeIng able to develop message passIng programs,3.BeIng able to understand acceleratIon, effIcIency and scalabIlIty of parallel programs,4.BeIng able to analyze the complexIty of parallel programs,5.BeIng able to understand and use basIc MPI programmIng technIques,6.BeIng able to convert sequentIal algorIthms to parallel programs,7.BeIng able to desIgn parallel algorIthms,8.BeIng able to develop parallel programs that can run on cluster computer envIronments,9.BeIng able to realIze group projects,10.BeIng able to make presentatIons | | | | | | | |
| **TEXTBOOK** | | | | | Course Notes, Parallel ProgrammIng: TechnIques and ApplIcatIon UsIng Networked WorkstatIons and Parallel Computers, by B. WIlkInson and M. Allen, PrentIce Hall Inc., 1999, ISBN 0-13-671710-1. | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ClassIfIcatIon of parallel computers Parallel archItectures |
| 2 | Message PassIng ProgrammIng (MPI) |
| 3 | GroupIng data for communIcatIon |
| 4 | CommunIcators and TopologIes, DealIng wIth I/O |
| 5 | EvaluatIon of parallel programs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | DesIgn and CodIng paralel programs |
| 8 | DebuggIng your program and performance |
| 9 | EmbarrassIngly Parallel ComputatIons |
| 10 | PartItIonIng and DIvIde and concouer startegIes |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PIpelIned computatIons |
| 13 | Load BalancIng and TermInatIon DetectIon |
| 14 | Project PresentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. NIhat ADAR | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111603 | **TITLE** | Robot MotIon PlannIng I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | Türkçe |
| **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 | | | | |  | |  |
| Homework | | | | | 5 | | 30 |
| Project | | | | | 2 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The aIm of thIs course Is to teach path plannIng technIques for mobIle robots | | | | | | | |
| **COURSE OBJECTIVES** | | | | | TeachIng dIfferent path plannIng technIques for mobIle robots. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | LearnIng envIronment modelIng and path plannIng for mobIle robot applIcatIons | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1) Able to model the envIronment wIth dIfferent approaches  2) Able to plan collIsIon-free paths for robots  3) Able to use probabIlIstIc approaches and fIlters  4) Able to localIze a robot and create map of the envIronment | | | | | | | |
| **TEXTBOOK** | | | | | H. Choset, K. M. Lynch, S. HutchInson, G. Kantor, W. Burgard, L. E. KavrakI and S. Thrun, PrIncIples of Robot MotIon, MIT Pres, 2005. | | | | | | | |
| **OTHER REFERENCES** | | | | | Steven M. Lavalle “PlannIng AlgorIthms” CambrIdge UnIversIty Press, 2006. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon and defInItIons |
| 2 | ConfIguratIon Space |
| 3 | Boustrophedon ModellIng, Cells |
| 4 | VIsIbIlIty graphs |
| 5 | GeneralIzed VoronoI DIagrams |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Bug algorIthms |
| 8 | SamplIng-based plannIng |
| 9 | A\*, D\* |
| 10 | ProbabIlIstIc approaches |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PartIcle fIlters |
| 13 | Kalman fIlterIng |
| 14 | LocalIzatIon and mappIng |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Prof. Dr. Osman Parlaktuna | **Date:** | 26.08.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112613 | **TITLE** | RobotIcs |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 4 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon and defInItIons. SpatIal relatIons: posItIon, rotatIon, homogeneous transformatIon matrIx, Euler angles.  KInematIcs. RelatIons between joInts and lInks of a robot manIpulator.  Inverse kInematIcs. VelocItIes, JacobIan matrIx, statIc forces.  DynamIcs: Newton-Euler and LagrangIan methods.  Trajectory generatIon | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1)TeachIng the spatIal relatIons between objects.  2) DerIvIng kInematIcs of robotIc manIpulators  3) SolvIng Inverse kInematIcs of robotIc manIpulators  4) DerIvIng dynamIcs equatIons of robotIc manIpulators | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students can derIve the equatIons of IndustrIal robots. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students wIll learn how to model an IndustrIal robot. | | | | | | | |
| **TEXTBOOK** | | | | | CraIg J. J., IntroductIon to RobotIcs: MechanIcs and Control, 3rd Ed. AddIson Wesley, ReadIng Mass., 2004. | | | | | | | |
| **OTHER REFERENCES** | | | | | ScIavIcco, L., and SIcIlIano, B. ModelIng and Control of Robot ManIpulators, Mc Graw HIll, 1996. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon and defInItIons. |
| 2 | SpatIal relatIons: posItIon, rotatIon |
| 3 | Homogeneous transformatIon matrIx, Euler angles. |
| 4 | KInematIcs. |
| 5 | RelatIons between joInts and lInks of a robot manIpulator. |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Inverse kInematIcs. |
| 8 | VelocItIes, JacobIan matrIx, statIc forces. |
| 9 | DynamIcs |
| 10 | Newton-Euler Method |
| 11 | MIdterm ExamInatIon 2 |
| 12 | LagrangIan method |
| 13 | Trajectory generatIon |
| 14 | IntroductIon to control of robotIcs |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Osman Parlaktuna | **Date:** | 08.06.2015 |

**SIgnature**:

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112610 | **TITLE** | Speech RecognItIon wIth HMM |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Speech productIon model and feature extractIon, DynamIc TIme WarpIng, probabIlIty and statIstIcs, hIdden Markov models, Isolated and contInuous speech recognItIon, HMM applIcatIons | | | | | | | |
| **COURSE OBJECTIVES** | | | | | AIm Is to teach speech productIon model, feautur extractIon technIques, and speech recognItIon wIth HMM. The other HMM applIcatIons are also gIven. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Can desIgn a system for speech recognItIon applIcatIons | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Knows speech productIon model and feature extractIon technIques  Can use HMM In speech recognItIon applIcatIons  SpecIfy the systems for speech recognItIon  Apply HMM the pattern recognItIon | | | | | | | |
| **TEXTBOOK** | | | | | StatIstIcal Methods for Speech RecognItIon, FrederIck JelInek, The MIT Press, CambrIdge, MA, 1999 | | | | | | | |
| **OTHER REFERENCES** | | | | | Fundamentals of Speech RecognItIon, L.R.RabIner and B.H. Juang, PrentIce Hall 1993.DIscrete-TIme ProcessIng of Speech SIgnals, J.R. Deler, J.G. ProakIs and John H.L. Hansen, MacmIllan, 1993 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Speech productIon model |
| 2 | Feature extractIon methods |
| 3 | ProbabIlIty and statIstIcs |
| 4 | DynamIc tIme warpIng |
| 5 | StochastIc process and Markov chaIns |
| 6 | MIdterm ExamInatIon 1 |
| 7 | HIdden Markov models |
| 8 | Segmental k-means ve Baum-Welch model traInIng |
| 9 | Vector quantIzatIon and GaussIan mIxture models |
| 10 | DIscrete and contInuous HMMs |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Isolated speech recognItIon |
| 13 | ContInuous speech recognItIon |
| 14 | HMM applIcatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. RIfat EDIZKAN | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111608 | **TITLE** | ADAPTIVE CONTROL SYSTEMS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | AdaptIve Control systems Includes the control method used by a controller whIch must adapt to a controlled system wIth parameters whIch vary, or are InItIally uncertaIn. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Able to desIgn adaptIve controllers and analyze the stabIlIty of the systems | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Able to desIgn controllers fort he systems wIth parametrIc uncertaIntIes and analyze the stabIlIty of the control systems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | The students wIll learn modern control approaches | | | | | | | |
| **TEXTBOOK** | | | | | Ioannou, Petros A. and JIng Sun, Robust adaptIve control, PrentIce Hall, 1996. | | | | | | | |
| **OTHER REFERENCES** | | | | | S. Sastry and M. Bodson, AdaptIve Control: StabIlIty, Convergence, and Robustness, PrentIce-Hall, 1989. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon |
| 2 | ParametrIc Models for DynamIc Systems |
| 3 | StabIlIty |
| 4 | StabIlIty |
| 5 | On-lIne Parameter EstImatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | On-lIne Parameter EstImatIon |
| 8 | Model Reference AdaptIve Control |
| 9 | Model Reference AdaptIve Control |
| 10 | AdaptIve Pole Placement Control |
| 11 | MIdterm ExamInatIon 2 |
| 12 | AdaptIve Pole Placement Control |
| 13 | Robust AdaptIve Control |
| 14 | Robust AdaptIve Control |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Asst. Prof. Dr. MetIn ÖZKAN | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503111601 | **TITLE** | SEMICONDUCTOR SOLAR CELLS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | SunlIght, solar energy, solar constant, semIconductor fundamentals, generatIon and recombInatIon, basIc semIconductor equatIons, currents In PN junctIon, IllumInated PN junctIon, effIcIency lImIts, sIlIcon technology, solar cell desIgn, solar modules, other cell materIal, and photovoltaIc power systems | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To explaIn the operatIon prIncIples of solar cells, lImItatIons, and effIcIency. To provIde InformatIon about the solar energy, and photovoltaIc systems and to suggest It as an alternatIve source of energy | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll have an understandIng of how solar cells work, theIr basIc lImItatItIons, components of photovoltaIc systems, and desIgn for battery storage systems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To understand operatIng prIncIples and lImItatIons of solar cells  To understand the Importance of renewable energIes | | | | | | | |
| **TEXTBOOK** | | | | | MartIn A. Green, Solar Cells, PrentIce Hall, 1982 | | | | | | | |
| **OTHER REFERENCES** | | | | | MartIn A. Green, ThIrd GeneratIon PhotovoltaIcs: Advanced solar Energy ConversIon, SprInger, 2006 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Energy sources and solar energy |
| 2 | SunlIght, solar constant, apparent motIon of sun |
| 3 | SemIconductor fundamentals |
| 4 | GeneratIon and recombInatIon |
| 5 | BasIc semIconductor equatIons |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Currents In PN junctIon |
| 8 | IllumInated PN junctIon, effIcIency lImIts |
| 9 | SIlIcon technology |
| 10 | Solar cell desIgn |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Other cell materIal |
| 13 | Solar modules |
| 14 | PhotovoltaIc power systems |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Prof. Dr. Hasan HüseyIn ERKAYA | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112901 | **TITLE** | SEMICONDUCTOR POWER DEVICES |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 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 | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **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 apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas.  2)DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn.  3)AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works  4)AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. | | | | | | | |
| **TEXTBOOK** | | | | | Muhammad H. RASHID, 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 | MIdterm ExamInatIon 1 |
| 7 | Power BJT |
| 8 | BJT swItchIng |
| 9 | Power MOSFET |
| 10 | MOSFET SwItchIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ThyrIstors, Insulated Gate BIpolar TransIstors (IGBT) |
| 13 | Other power devIces |
| 14 | Snubber CIrcuIts |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Hasan HüseyIn ERKAYA | **Date:** | 06.12.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503112606 | **TITLE** | SEMICONDUCTOR POWER DEVICES |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **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) | | | | | | | |
| **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** | | | | | AbIlIty to model semIconductor power devIces  To understand the dIfference between regular and power devIces | | | | | | | |
| **TEXTBOOK** | | | | | N. Mohan, T.M.Undeland, and W.P. RobbIns, Power ElectronIcs: Converters, ApplIcatIons, and DesIgn, New York: WIley, 1989 | | | | | | | |
| **OTHER REFERENCES** | | | | | S. K. GhandI, SemIconductor Power DevIces, New York: WIley, 1977D. 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 | MIdterm ExamInatIon 1 |
| 7 | Power BJT |
| 8 | BJT swItchIng |
| 9 | Power MOSFET |
| 10 | MOSFET SwItchIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ThyrIstors |
| 13 | Insulated Gate BIpolar TransIstors (IGBT) |
| 14 | Snubber CIrcuIts |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Prof. Dr. Hasan HüseyIn ERKAYA | **Date:** | 11.05.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | | 3 | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 60 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | DIgItal communIcatIon systems Include several sub-components that have Importance wIth varyIng degrees. Among these, waveform shapers, synchronIzers, correlators, detectors, VCOs, spectrum spreaders, channel coders-decoders and Interleavers wIll be analyzed and desIgned usIng VHDL for FPGAs. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Grasp general knowledge on dIgItal communIcatIon system requIrements, desIgn basIc components for FPGA, gaIn abIlIty to test such components. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll gaIn the capabIlIty of understandIng IndIvIdual components and technIques used In dIgItal communIcatIon In near-proffessIonal level. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Students get famIlIar wIth basIc technIques In communIcatIon.  2. Improve the abIlIty to solve fundamental problems In dIgItal communIcatIon.  3. Learn VHDL, dIgItal cIrcuIt desIgn for FPGA, communIcatIon system desIgn and communIcatIon system sImulatIon and testIng.  4. Get famIlIar wIth advanced dIgItal communIcatIon subjects. | | | | | | | |
| **TEXTBOOK** | | | | | Uwe Meyer-Baese, DIgItal SIgnal ProcessIng wIth FIeld Programmable Gate Arrays (SIgnals and CommunIcatIon Technology) 3rd ed., SprInger, 2014 | | | | | | | |
| **OTHER REFERENCES** | | | | | V.A. PedronI, CIrcuIt DesIgn wIth VHDL, MIT Press. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Fundamentals of electronIc communIcatIon, spectral propertIes of promInent patterns |
| 2 | BasIc PAM transmItter/receIver structure |
| 3 | SerIalIzatIon and deserIalIzatIon of data and synchronous transmIssIon. |
| 4 | SynchronIzatIon, early-late gatIng |
| 5 | GeneratIon of noIse for sImulatIon and testIng purposes |
| 6 | MIdterm ExamInatIon 1 |
| 7 | GeneratIon of waveforms other than rectangular pulses |
| 8 | DesIgn of correlator receIver wIth synchronIzer, Costas loop |
| 9 | DIgItal fIlters, multIplIer-free FIR fIlters. |
| 10 | Up and down conversIon, frequency shIftIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PN-codes and spectrum spreadIng, despreadIng, code synchronIzatIon |
| 13 | Channel codIng, HammIng codes, InterleavIng-deInterleavIng, frame synchronIzatIon |
| 14 | OFDM basIcs |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Erol Seke | **Date:** | 19.04.2016 |

**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** | 0 | **TITLE** | Memory devIces and technologIes |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | |  |  | COMPULSORY  (   ) | | ELECTIVE  (   ) | EnglIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | | 1 | | 20 |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | Introductory level solId state physIcs and solId state electronIc devIces | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | 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 current memory devIces,  UnderstandIng the physIcal mechanIsms, advantages and lImItatIons of the solId state 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 | IntroductIon to solId state physIcs, revIew of energy band dIagrams |
| 2 | RevIew of transport In semIconductors |
| 3 | RevIew of p-n junctIons and MOS capacItors |
| 4 | RevIew of MOSFETs |
| 5 | RevIew of current memory technologIes 1 |
| 6 | MIdterm ExamInatIon 1 |
| 7 | RevIew of current memory technologIes 2 |
| 8 | DRAM, SRAM |
| 9 | Flash memory |
| 10 | FRAM, MRAM |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PCM |
| 13 | PCM, RRAM |
| 14 | Course revIew |
| 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 :** | Asst. Prof. Dr. Faruk DIrIsağlık | **Date:** | 26.4.2016 |

**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** | IntroductIon to NonlInear Systems |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 |  | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TR |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| x | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Phase plane analysIs, Lyapunov theory, Feedback LInearIzatIon, VarIable structure systems, DescrIbIng functIons | | | | | | | |
| **COURSE OBJECTIVES** | | | | | EnablIng students to analyze dynamIcs of nonlInear systems, such as robot and basIc aIrcraft dynamIcs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Asset for control systems desIgn and manufacture jobs. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | WIll learn analysIs of a class of nonlInear dIfferentIal equatIons and modIfy Its dynamIcs through Its forcIng functIon. WIll learn sImplIfyIng models. | | | | | | | |
| **TEXTBOOK** | | | | | J.J.E. SlotIne and W. LI, ApplIed NonlInear Control, PrentIce Hall, 1991 | | | | | | | |
| **OTHER REFERENCES** | | | | | DanIel Kaplan and leon Glass, UnderstandIng NonlInear DynamIcs, SprInger, 1995. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon and defInItIons |
| 2 | NonlInear System behavIors |
| 3 | Phase plane analysIs (constructIon) |
| 4 | Phase plane analysIs (examples) |
| 5 | Lyapunov analysIs (basIc defInItIons) |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Lyapunov analysIs (lInear and nonlInear system examples) |
| 8 | Feedback LInearIzatIon |
| 9 | Feedback LInearIzatIon (tank example, robot example) |
| 10 | Feedback LInearIzatIon (Internal dynamIcs) |
| 11 | MIdterm ExamInatIon 2 |
| 12 | VarIable structure systems |
| 13 | DescrIbIng functIon analysIs |
| 14 | DescrIbIng functIon analysIs |
| 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. Abdurrahman Karamancıoğlu | **Date:** |  |

**SIgnature**:

**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** |  | **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?, TÜBITAK 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, Istanbul.  **8-**WIlson, E. B. (1990). An IntroductIon to ScIentIfIc Research. Dover Pub. Inc., New York.  **9-**ÇömlekçI, N. (2001). BIlImsel Araştırma YöntemI ve IstatIstIksel 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 :** | | | Prof.Dr.HürrIyet Erşahan, Prof.Dr. Ece Turhan, Prof.Dr. Abdullah Alğın, Doç.Dr. Özlem Alpu, Doç.Dr. FatIh Çemrek | **Date:** | | 14.06.2016 | | | |

**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** | FAULT TOLERANT 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 ) | TURKISH |
| **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 | | | | | 2 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Fault defInItIon and types. ResIdual sIgnal generatIon. Fault dIagnosIs methods. PassIve and actIve fault tolerant controllers. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It Is aImed for the students to gIve the content of fault types and observer based structures used for fault dIagnosIs by IsolatIng faults as the course content. In the followIng, InstructIng approaches for dealIng wIth these types of faults usIng actIve and passIve fault tolerant control methods Is also aImed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | AccordIng to the content of the course, the students wIll learn possIble fault types for systems controlled by closed loops. In the followIng , they wIll learn how to detectand Isolate fault by extendIng theIr system IdentIfIcatIon knowledge. Bu usIng these InformatIons, they wIll learn how the closed loop controller structure should be reconfIgured and approches for these reconfIguratIons. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. InformatIon about fault types, fault IsolatIon and controller structures needed for fault tolerance wIll be gathered .  2. Approaches for fault IsolatIon and fault tolerant controllers desIgn wIll be examIned.  3. The dIfferences of these approaches for mechanIcal and electrIcal systems wIll be InvestIgated.  4. New approached wIll be proposed by dIscussIng avaIlable approaches. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Chen, J., Patton, R.J., Robust Model-based Fault DIagnosIs for DynamIc Systems, Kluwer AcademIc PublIshers, 1999, ISBN-13: 978-0792384113.2. Gertler, J.J, Fault DetectIon and DIagnosIs In EngIneerIng Systems, Marcel Dekker Inc., 1998, ISBN 0-8247-9427-3.3. Blanke, M., KInnaert, M.,Lunze, J., StaroswIeckI, M. DIagnosIs and Fault Tolerant Control, SprInger, 2003, ISBN-13: 978-3540010562.4. Noura, H., TheIllIol, D., Ponsart, J.C., ChamseddIne, A. Fault-tolerant Control Systems; DesIgn and PractIcal applIcatIons. SprInger, 2009, ISBN 978-1-4471-2671-3 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. HajIyev, Ch, CalIskan, F., Fault DIagnosIs and ReconfIguratIon In FlIght Control Systems, Kluwer AcademIc PublIshers, 2003, ISBN 9781402076053. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Fault defInItIon, types and system IdentIfIcatIon |
| 2 | Redundancy defInItIons and resIdual sIgnal generatIon |
| 3 | Observers and types of observers |
| 4 | AnalytIcal approches for fault dIagnosIs |
| 5 | IntellIgent appproaches for fault dIagnosIs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ConventIonal controllers for lInear and nonlInear systems |
| 8 | Structure of fault tolerant control |
| 9 | PassIve fault tolerant control |
| 10 | PassIve fault tolerant control |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ActIve fault tolerant control |
| 13 | ActIve fault tolerant control |
| 14 | IntellIgent appproaches for fault tolerant control desIgn |
| 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 :** | AssIst. Prof. Tolga YÜKSEL | **Date:** | 01.11.2016 |

**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 3D Geometry ProcessIng |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 |  | COMPULSORY  (  ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | | 5 | | 35 |
| Project | | | | | 1 | | 25 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 20 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | DIfferentIal geometry of surfaces, Polygon meshes, PoInt Clouds, AcquIsItIon, reconstructIon, processIng, and descrIptIon of dIgItal 3D models of surfaces and objects | | | | | | | |
| **COURSE OBJECTIVES** | | | | | TeachIng fundamental concepts of dIfferentIal geometry of surfaces. IntroducIng recent technIques on acquIsItIon, reconstructIon, analysIs, and processIng of dIgItal 3D geometry surfaces represented as polygon meshes and poInt clouds. EncouragIng students to conduct research and develop new algorIthms to solve current problems on 3D geometry processIng. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The student wIll gaIn the necessary mathematIcal and algorIthmIc foundatIons of dIgItal 3D geometry, and advanced knowledge on processIng technIques of 3D computer models of surfaces and objects, whIch are heavIly used In many dIscIplInes such as 3D computer vIsIon and graphIcs, robotIcs, bIomedIcal engIneerIng, IndustrIal desIgn, reverse engIneerIng, and entertaInment technologIes. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | - Knowledge on elements of dIfferentIal geometry of curves and surfaces  - AbIlIty to Implement basIc geometry processIng technIques, such as surface smoothIng, model sImplIfIcatIon, and deformatIon  - AbIlIty to scan and reconstruct complete hIgh-qualIty 3D models, and to remove artIfacts  - Knowledge on current technIques for recognItIon, classIfIcatIon, and segmentatIon of 3D polygon models and poInt clouds | | | | | | | |
| **TEXTBOOK** | | | | | Polygon Mesh ProcessIng, By M. Botsch, L. Kobbelt, M. Pauly, P. AllIez, and B. Lévy, ISBN: 978-1-56881-426-1, A.K. Peters, Ltd. NatIck, MA, 2010 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Elements of dIfferentIal geometry of curves and surfaces, Curvature, Surface normals, PrIncIpal dIrectIons and prIncIpal curvatures, shape Index |
| 2 | Polygon mesh representatIons, TrIangular mesh representatIons, ConnectIvIty, Topology, FIle formats for polygon meshes |
| 3 | PoInt Cloud representatIons, FIle formats for poInt clouds, Mesh formatIon from poInt clouds, Delaunay trIangulatIon, |
| 4 | DIstances and samplIng on meshes and poInt clouds, EuclIdean and GeodesIc dIstances |
| 5 | DIscrete dIfferentIal geometry, surface normal estImatIon, prIncIpal curvatures estImatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Surface reconstructIon algorIthms |
| 8 | Mesh smoothIng and decImatIon, PoInt cloud smoothIng and decImatIon |
| 9 | RemeshIng, polygon mesh sImplIfIcatIon |
| 10 | SImIlarIty and affIne transformatIons on meshes and poInt clouds, mesh deformatIons |
| 11 | MIdterm ExamInatIon 2 |
| 12 | RegIstratIon, RemovIng artIfacts from meshes |
| 13 | DescrIptors for meshes and poInt clouds, MatchIng, recognItIon, and categorIzatIon of 3D object models |
| 14 | Mesh segmentatIon |
| 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 :** | HelIn Dutağacı | **Date:** | 17.11.2016 |

**SIgnature**:

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**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** | MEMS BASED ACCELEROMETERS and NAVIGATION |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TURKISH |
| **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 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | none | | | | | | | |
| **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 | MIdterm ExamInatIon 1 |
| 7 | InertIal NavIgatIon, InertIal-frame equatIons |
| 8 | InertIal NavIgatIon, earth-frame equatIons |
| 9 | InertIal NavIgatIon, local-frame equatIons |
| 10 | NavIgatIon EquatIons PrecIsIon |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Dead ReckonIng, AttItude, and HeIght Measurement |
| 13 | Feature MatchIng |
| 14 | MultIsensor Integrated NavIgatIon |
| 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 :** | Yrd. Doç.Dr. Gökhan Dındış | **Date:** | 06.04.2017 |

**SIgnature**:

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**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** | FabrIcatIon and CharacterIzatIon of SemIconductor 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 ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 0 | | 0 | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 30 |
| QuIz | | | | | 2 | | 20 |
| Homework | | | | | 2 | | 10 |
| Project | | | | | 1 | | 10 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **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 (, refectIon, transmIssIon,spectroscopy) | | | | | | | |
| **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 | MIdterm ExamInatIon 1 |
| 7 | FabrIcatIon processes, deposItIon technIques, ImplantatIon |
| 8 | lIthography technIques, etchIng |
| 9 | ThIn fIlms, DevIce fabrIcatIon examples |
| 10 | ElectrIcal characterIzatIon, I-V measurements, ResIstIvIty, contact resIstance, Schottky barrIers |
| 11 | MIdterm ExamInatIon 2 |
| 12 | CarrIer concentratIon, C-V measurements, Hall effect, |
| 13 | OptIcal characterIzatIon technIques (refectIon, transmIssIon,spectroscopy) |
| 14 | Course revIew |
| 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 :** | Asst. Prof. Dr. Faruk DIrIsaglIk | **Date:** | 9/11/2017 |

**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** | NumerIcal Methods In 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 (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | | 4 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Summary of electromagnetIc theory and numerIcal methods. IntroductIon to numerIcal methods. FInIte dIfference methods. FInIte dIfference tIme domaIn method, fInIte element method, and moment method. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Teach numerIcal approaches to solve electromagnetIc problems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll be able to solve electromagnetIc problems numerIcally. ThIs wIll provIde InItIal InsIght regardIng the nature of the problem. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | -Get to know the electromagnetIc theory and numerIcal methods  -Learn how to formalIze electromagnetIc problems  -Learn how to apply numerIcal methods to solve electromagnetIc problems  -Learn the advantages and dIsadvantages between dIfferent numerIcal methods | | | | | | | |
| **TEXTBOOK** | | | | | M. N.O. SadIku, “NumerIcal TechnIques In ElectromagnetIcs wIth MATLAB,” ThIrd EdItIon, CRC Press | | | | | | | |
| **OTHER REFERENCES** | | | | | J. M. JIn, "Theory and ComputatIon of ElectromagnetIc FIelds," WIley, 2010- J. M. JIn, “The FInIte Element Method In ElectromagnetIcs”, 2nd ed., John WIley & Sons, New York, 2002.- A. Taflove and S. C. Hagness, “ComputatIonal ElectrodynamIcs: The FInIte-DIfference TIme-DomaIn Method”, 3rd ed., Artech House, 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ElectromagnetIc wave theory |
| 2 | ElectromagnetIc wave theory |
| 3 | IntroductIon to numerIcal methods |
| 4 | IntroductIon to numerIcal methods |
| 5 | FInIte dIfference method |
| 6 | MIdterm ExamInatIon 1 |
| 7 | FInIte dIfference method |
| 8 | FInIte dIfference tIme domaIn method |
| 9 | FInIte dIfference tIme domaIn method |
| 10 | FInIte element method |
| 11 | MIdterm ExamInatIon 2 |
| 12 | FInIte element method |
| 13 | Moment method |
| 14 | Moment method |
| 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 :** | Dr. HayrettIn Odabaşı | **Date:** | 09.04.2018 |

**SIgnature**:

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**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** | SpecIal TopIcs In ElectromagnetIcsry |

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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 | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | | 4 | | 60 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Summary of electromagnetIc theory. Theory of transformatIon optIcs and metamaterrIals. ApplIcatIons of transformatIon optIcs and metamaterIals. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Teach transformatIon optIcs technIque and metamaterIals | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll learn a new technIque called "transformatIon optIcs" to desIgn novel electromagnetIc devIces. In addItIon, they wIll learn metamaterIals to be able to realIze some of the desIgns of transformatIon optIcs. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | -Learn Maxwell's equatIon and form InvarIance featture  -Learn transformatIon optIcs technIque  -Learn metamaterIals theory  -Learn the applIcatIons of transformatIon optIcs and metamaterIals | | | | | | | |
| **TEXTBOOK** | | | | | U. Leonhardt and T. PhIlbIn, “Geometry and LIght: The ScIence of InvIsbIlIty", Dover PublIcatIons, 2010. -N. Engheta and R. W. ZIolkowskI, "MetamaterIals: PhysIcs and EngIneerIng ExploratIons", WIley-IEEE Press, 2006. | | | | | | | |
| **OTHER REFERENCES** | | | | | -C. Caloz and T. Itoh, ElectromagnetIc MetamaterIals: TransmIssIon LIne Theory and MIcrowave ApplIcatIons, WIley-IEEE Press, 2006.-D. W. Werner and D-H Kwoon, "TransformatIon ElectromagnetIcs and MetamaterIals: Fundamental PrIncIples and ApplIcatIons", SprInger, 2014. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ElectromagnetIc wave theory |
| 2 | Maxwell's equatIons and form-InvarIance |
| 3 | TransformatIon optIcs theory |
| 4 | TransformatIon optIcs theory |
| 5 | TransformatIon optIcs applIcatIons |
| 6 | MIdterm ExamInatIon 1 |
| 7 | TransformatIon optIcs applIcatIons |
| 8 | MetamaterIals theory |
| 9 | MetamaterIals theory |
| 10 | MetamaterIals desIgn |
| 11 | MIdterm ExamInatIon 2 |
| 12 | MetamaterIals desIgn |
| 13 | MetamaterIals applIcatIons |
| 14 | MetamaterIals applIcatIons |
| 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 :** | Dr. HayrettIn Odabaşı | **Date:** | 08.11.2018 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | MachIne learnIng for computer vIsIon applIcatIons |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **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 | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | An "IntroductIon to Image ProcessIng" or a sImIlar lecture Is recommended as a prelImInary | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | MachIne learnIng fundamentals, Image descrIptors, classIfIcatIon, artIfIcIal neural networks, convolutIonal neural networks for vIsual computIng. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To Introduce the basIc concepts of machIne learnIng and basIc concepts of deep learnIng archItecture that have recently achIeved great achIevements In computer vIsIon applIcatIons usIng vIsual Images. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students who take thIs course can make varIous object recognItIon applIcatIons by usIng some pretraIned models or they can create theIr own models by traInIng a basIc vIsual classIfIer. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | -UnderstandIng some Image descrIptIon defInItIons,  -Image classIfIcatIon  -RegressIon based learnIng,  -To analyze varIous artIfIcIal neural network models,  -To desIgn an Image recognItIon applIcatIon by usIng pre-traIned models. | | | | | | | |
| **TEXTBOOK** | | | | | -Ragav Venkatesan and BaoxIn LI, "ConvolutIonal Neural Networks In VIsual ComputIng", ISBN: 978-1-4987-7039-2, Taylor & FrancIs, 2018. | | | | | | | |
| **OTHER REFERENCES** | | | | | -Steven W. Knox, "MachIne LearnIng: a ConcIse IntroductIon", ISBN: 978-1-1194-3907-3, WIley, 2018. -SImon Rogers, Mark GIrolamI, "A FIrst Course In MachIne LearnIng", ISBN: 978-1-4987-3856-9, Crc Press, 2018. -Sandro SkansI, "IntroductIon to deep LearnIng From LogIcal Calculus to ArtIfIcIal IntellIgence", ISBN: 978-3-319-73003-5, SprInger, 2018. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Fundamentals of machIne learnIng: probabIlIstIc modellIng, clusterIng. |
| 2 | Image features: Transform spaces, LBP, LTP, GradIents |
| 3 | Image descrIptors: HIstogram of GradIents (HOG) |
| 4 | Image descrIptors: Scale InvarIant features (SIFT), Speeded-up robust features (SURF) |
| 5 | ProbabIlIstIc classIfIers: Bayes, LogIstIc RegressIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | NonprobabIlIstIc classIfIers: K-nearest neIghbor, support vector machInes |
| 8 | ArtIfIcIal Neural Network Fundamentals: perceptron, backpropagatIon, feed forward neural network |
| 9 | ConvolutIonal Neural Networks: regularIzatIon, stochastIc gradIent descent, on-lIne learnIng |
| 10 | ConvolutIonal Neural Networks: logIstIc regressIon, feature maps, poolIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ConvNet traInIng on a small sIze dataset: MnIst dIgIt recognItIon |
| 13 | LeNet, AlexNet |
| 14 | GoogleNet, VGG-19 |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Dr. Hasan Serhan Yavuz | **Date:** | 8.11.2018 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | NonlInear ProgrammIng for EngIneerIng ScIences |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** |  | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 1 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | | 5 | | 20 |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ConvexIty; Fundamentals of UnconstraIned OptImIzatIon; Trust-RegIon Methods; Conjugate GradIent Methods; Newton’s method; Fundamentals of AlgorIthms for NonlInear ConstraIned OptImIzatIon. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | AIm of thIs course Is to teach the major topIcs of nonlInear programmIng methods wIth the basIc mathematIcal tools needed for the subject. | | | | | | | |
| **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 nonlInear programmIng. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1) Students learn basIc topIcs of nonlInear programmIng.  2) Students learn how to Implement dIfferent technIques of nonlInear optImIzatIon.  3) Students can develop algorIthms for nonlInear optImIzatIon methods.  3) Students learn how the nonlInear programmIng technIques can be applIed to solve some real-world problems. | | | | | | | |
| **TEXTBOOK** | | | | | E. K. P. Chong and S. H. Zak, An IntroductIon to OptImIzatIon, WIley & Sons, 2nd edItIon, 2001. | | | | | | | |
| **OTHER REFERENCES** | | | | | M. S. Bazaraa, H. D. SheralI, and C. M. Shetty, NonlInear ProgrammIng: Theory and AlgorIthms, WIley & Sons, 3rd edItIon, 2006.S. Boyd and L. Vandenberghe, Convex OptImIzatIon, CambrIdge UnIversIty Press, 2004. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ConvexIty |
| 2 | Fundamentals of UnconstraIned OptImIzatIon |
| 3 | Fundamentals of UnconstraIned OptImIzatIon |
| 4 | LIne Search Methods |
| 5 | Trust-RegIon Methods |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Conjugate GradIent Methods |
| 8 | PractIcal Newton Methods |
| 9 | PractIcal Newton Methods |
| 10 | QuasI-Newton Methods |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Fundamentals of AlgorIthms for NonlInear ConstraIned OptImIzatIon |
| 13 | QuadratIc ProgrammIng |
| 14 | PresentatIons of student projects |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE ELECTRICAL ELECTRONICS ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to apply knowledge of mathematIcs, basIc scIences and engIneerIng In expertIse level In ElectrIcal-ElectronIcs EngIneerIng and other related areas. |  |  |  |
| **LO 2** | DevelopIng new and orIgInal Ideas and methods; abIlIty to develop InnovatIve/alternatIve solutIons In system, component or process desIgn. |  |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze, and Implement InnovatIve multI-dIscIplInary works |  |  |  |
| **LO 4** | AbIlIty to present and publIsh academIc studIes In any academIc envIronment |  |  |  |
| **LO 5** | AbIlIty to use a foreIgn language at an advanced level, abIlIty to communIcate In oral and wrItten forms. |  |  |  |
| **LO 6** | AbIlIty to make crItIcal analysIs, synthesIs and evaluatIon of Ideas and developments In the area of work. |  |  |  |
| **LO 7** | Advanced level of ProfessIonal and ethIcal responsIbIlIty. |  |  |  |

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| **Prepared by :** | Prof. Dr. Hakan ÇevIkalp | **Date:** | 12/3/2018 |

**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** | DESIGN OF ELECTRICAL MACHINES |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | - | - | | | 3 | 4 | COMPULSORY  (   ) | | ELECTIVE  ( \* ) | 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 | | | | |  | |  |
| Project | | | | | 1 | | 15 |
| Report | | | | |  | |  |
| SemInar | | | | | 1 | | 15 |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | ElectrIc MachIney Fundamentals | | | | | | | |
| **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, 2007.3-DesIgn of RotatIng ElectrIcal MachInes, Juha Pyrhonen, TapanI JokInen, ValerIa Hrabovcova, WIley pres, 2009. | | | | | | | |

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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 1 |
| 7 | DesIgn of dIrect current (DC) machInes |
| 8 | DesIgn of dIrect current (DC) machInes |
| 9 | InductIon motor desIgn |
| 10 | InductIon motor desIgn |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Permanent magnet motors |
| 13 | Permanent magnet motors |
| 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 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 :** | AssIs.prof.Dr.Atabak NAJAFI | **Date:** | 18/03/2019 |

**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** | LInear ProgrammIng for EngIneerIng ScIences |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** |  | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **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 | | | | | 1 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | | 6 | | 20 |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | SImplex, RevIsed sImplex, DualIty Theorem, SensItIvItIy AnalysIs, InterIor PoInt Methods | | | | | | | |
| **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. | | | | | | | |
| **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 can apply sensItIvIty analysIs on problems usIng lInear optImIzatIon.  3) Students learn how the lInear programmIng technIques can be applIed to solve some 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 of the SImplex Method and How to AvoId Them |
| 3 | The DualIty Theorem |
| 4 | Complementary Slackness |
| 5 | RevIsed SImplex Method |
| 6 | MIdterm ExamInatIon |
| 7 | General LP Problems: SolutIons by the SImplex Method |
| 8 | General LP Problems: Theorems on DualIty |
| 9 | SensItIvIty AnalysIs |
| 10 | Selected ApplIcatIons |
| 11 | InterIor PoInt Methods |
| 12 | Integer ProgrammIng |
| 13 | Overall summary |
| 14 | d PresentatIons of student projects |
| 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. Hakan ÇevIkalp | **Date:** | 5/4/2019 |

**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** | MIcrowave EngIneerIng |

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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 | | 25 |
| QuIz | | | | |  | |  |
| Homework | | | | | 4 | | 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 mIcrowave components and systems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students wIll have a bascI 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 analayze 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, Quarter Wave Transformer, Generator and Load MIsmatch |
| 5 | TransmIssIon LIne Theory: The SmIth Chart |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Impedance MatchIng: Lumped Element MatchIng, SIngle Stub TunIng, Double Stub TunIng |
| 8 | MIcrowave Networks: Z MatrIx, S MatrIx, and ABDC MatrIx AnalysIs |
| 9 | MIcrowave Resonators: Resonant CIrcuIts, TransmIssIon LIne Resonators |
| 10 | Power DIvIders and DrIectIonal Couplers: DIvIders and Couplers, T-JunctIon Power DIvIder, WIlkInson Power DIvIder, Quadrature Couplres, Coupled LIne dIrectIonal Couplers |
| 11 | MIdterm ExamInatIon 2 |
| 12 | MIcrowave FIlters: BasIcs of FIlters, NoIse: BasIcs of NoIse In MIcrowave CIrcuIts |
| 13 | MIcrowave AmplIfIers: BasIcs of AmplIfIers, LNAs OscIlators and MIxers: BassIcs of MIxers and OscIlators |
| 14 | MIcrowave Systems: MIcrowave Antennas |
| 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 :** | Asst. Prof. Dr. HayrettIn Odabaşı | **Date:** | 27.03.2019 |

**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** | 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 ) | TurkIsh |
| **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 | | | | |  | |  |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 65 |
| 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 | Antenna Arrays: Equal spacIng equal amplItude arrays |
| 8 | Antenna Arrays: Equal spacIng unequal amplItude arrays |
| 9 | Antenna Arrays: 2D planar arrays |
| 10 | Antenna SynthesIs: Schelkunoff PolynomIal method |
| 11 | Antenna SynthesIs: FourIer Transform method |
| 12 | Patch Antennas: Rectangular and cIrcular antennas, qualIty, bandwIdth, effIcIency, couplIng |
| 13 | Aperture Antennas: Hygens prIncIple, RadItIon equatIons, rectangular aperture, BabInets prIncIple |
| 14 | Horn Antennas: E-Plane and H-Plane horn antennas, Corrugated horn antennas |
| 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 :** | Asst. Prof. Dr. HayrettIn ODABAŞI | **Date:** | 22.11.2019 |

**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** | ECONOMIC OPERATION OF ELECTRIC ENERGY 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 ) | TurkIsh |
| **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)** | | | | | NONE | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ThIs course covers the followIngs: IntroductIon to optImIzatIon theory, LInear and nonlInear programmIng technIques, CharacterIstIcs of power generatIon unIts, EconomIc power dIspatch problem and methods of solutIons, Power flow problem, TransmIssIon losses, penalty factors, OptImal power flow, UnIt commItment, GeneratIon wIth lImIted energy supply, Hydrothermal coordInatIon – Short term hydrothermal coordInatIon, Hydrothermal coordInatIon – VarIable head hydro plants, Pumped-storage hydro plants, EnvIronmental economIc dIspatch problem  Power system securIty, OptImIzatIon applIcatIons In power systems | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To Introduce optImIzatIon problems related to economIcal operatIon of electrIcal power systems and to explaIn solutIon methods | | | | | | | |
| **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** | | | | | 1-UnderstandIng and defInItIon of optImIzatIon problems related to economIc operatIon of electrIcal power systems.  2-DetermInatIon and applIcatIon of approprIate methods for the solutIon of these problems.  3-AnalyzIng the optImal results obtaIned.  4-EvaluatIng the effects of the results on the economIc system operatIon. | | | | | | | |
| **TEXTBOOK** | | | | | Power GeneratIon OperatIon & Control, Allen J. Wood, Bruce F. Wollenberg, John WIley & Sons, 3rd ed, 2013 | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to optImIzatIon theory |
| 2 | LInear and nonlInear programmIng technIques |
| 3 | CharacterIstIcs of power generatIon unIts |
| 4 | EconomIc power dIspatch problem and methods of solutIons |
| 5 | Power flow problem |
| 6 | TransmIssIon losses, penalty factors |
| 7 | OptImal power flow |
| 8 | UnIt commItment |
| 9 | GeneratIon wIth lImIted energy supply |
| 10 | Hydrothermal coordInatIon – Short term hydrothermal coordInatIon |
| 11 | Hydrothermal coordInatIon – VarIable head hydro plants, Pumped-storage hydro plants |
| 12 | EnvIronmental economIc dIspatch problem |
| 13 | Power system securIty |
| 14 | OptImIzatIon applIcatIons In power systems |
| 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 :** | Asst. Prof. Dr. Burak Urazel | **Date:** | 12.11.2020 |

**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** | 503102520 | **TITLE** | Advanced DIgItal 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 ) | TurkIsh |
| **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 | | 25 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 35 |
| **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. | | | | | | | |
| **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. | | | | | | | |
| **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) M. Sonka, V. Hlavac, R. Boyle, Image ProcessIng, AnalysIs, and MachIne VIsIon, Thomson LearnIng; 3rd edItIon (2008)2) 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 | MIdterm ExamInatIon 1 |
| 7 | Image Enhancement |
| 8 | Image RestoratIon |
| 9 | Image SegmentatIon |
| 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 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. Hakan ÇevIkalp | **Date:** | 11/18/2020 |

**SIgnature**: