**MATHEMATIC-COMPUTER 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](#C130) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 501701504 | [MATHEMATICS](#C20) | 7.5 | 3+0 | 3 | **C** | Turkish |
|  | Elective Course-1 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-2 | 7.5 | 3+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 | 3 | E | Turkish |
|  | Elective Course-4 | 7.5 | 3+0 | 3 | E | Turkish |
|  | Elective Course-5 | 7.5 | 3+0 | 3 | E | Turkish |
| 501602001 | Seminar | 7.5 | 0+1 | - | **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 |
| 501601702 | MSc THESIS STUDY | | 25 | | 0+1 | - | **C** | Turkish |
| 501601703 | SPECIALIZATION FIELD COURSE | | 5 | | 3+0 | - | **C** | Turkish |
|  | | Total of III. Semester | 30 |  | |  |  |  | |
| **IV. Semester** | | | | | | | | | |
| Code | | Course Title | ECTS | T+P | | Credit | C/E | Language | |
| 501601702 | | MSc THESIS STUDY | 25 | 0+1 | | - | **C** | Turkish | |
| 501601703 | | SPECIALIZATION FIELD COURSE | 5 | 3+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 |
| 501601501 | [ADVACED PROJECTIVE GEOMETRY I](#C52) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601521 | [ADVANCED DIFFERENTIAL GEOMETRY I](#C44) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602518 | [ADVANCED DIFFERENTIAL GEOMETRY II](#C45) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701503 | [ADVANCED GAME THEORY](#C51) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601534 | [ADVANCED LINEAR GEOMETRY I](#C47) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602529 | [ADVANCED LINEAR GEOMETRY II](#C48) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601512 | [ADVANCED NUMERICAL ANALYSIS I](#C49) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602532 | [ADVANCED NUMERICAL ANALYSIS II](#C50) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602502 | [ADVANCED PROJECTIVE GEOMETRY II](#C53) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601508 | [ADVANCED TOPOLOGY I](#C56) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602507 | [ADVANCED TOPOLOGY II](#C57) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702503 | [ALGEBRA WITH HASKELL](#C37) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601527 | [ALGEBRAIC TOPOLOGY I](#C9) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602522 | [ALGEBRAIC TOPOLOGY II](#C10) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602527 | [ANALYTICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQ-II](#C71) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601510 | [ANALYTICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS I](#C70) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601540 | [APPLICATION OF LIE GROUPS TO DIFFERENTIAL EQUATIONS-I](#C3) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702507 | [AXIOMATIC GEOMETRY](#C4) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702515 | [CAlculus of Variations](#C152) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601505 | [CATEGORY THEORY I](#C68) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602506 | [CATEGORY THEORY II](#C67) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602537 | [COCOA PROGRAMMING](#C11) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601503 | [COMBINATORIAL GEOMETRY -I](#C75) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602504 | [COMBINATORIAL GEOMETRY -II](#C76) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601506 | [COMMUTATIVE ALGEBRAS I](#C12) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702508 | [CONVEX GEOMETRY](#C131) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702509 | [Deep Lerarning](#C140) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602638 | [DIFFERANTIAL GEOMETRY OF CURVES AND SURFACES II](#C19) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601626 | [DIFFERANTIAL GEOMETRY OF CURVES AND SURFACES I](#C18) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601502 | [DIFFERENTIABLE MANIFOLDS I](#C14) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602503 | [DIFFERENTIABLE MANIFOLDS II](#C15) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701506 | [DYNAMIC SYSTEMS](#C132) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601514 | [FINITE GRAPHS AND APPLICATIONS I](#C112) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602528 | [FINITE GRAPHS AND APPLICATIONS II](#C113) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601531 | [FINITE LINEAR SPACES I](#C114) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702502 | [FUNCTIONAL APPROXIMATION THEORY II](#C21) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702501 | [GENERALIZED QUADRANGLES I](#C26) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601525 | [GROUP THEORY I](#C30) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602523 | [GROUP THEORY II](#C31) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602511 | [HIGHER DIFFERENTIAL GEOMETRY II](#C129) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601523 | [HIPERBOLIC GEOMETRY I](#C38) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602520 | [HIPERBOLIC GEOMETRY II](#C39) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601621 | [HOMOTOPICAL ALGEBRA](#C43) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601513 | [INITIAL AND BOUNDARY VALUE PROBLEMS I](#C5) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602517 | [INITIAL AND BOUNDARY VALUE PROBLEMS II](#C6) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601536 | [INTEGRABILITY AND PERTURBATION METHODS I](#C62) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602516 | [INTEGRAL EQUATIONS](#C59) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601539 | [INTEGRAL TRANSFORMATIONS](#C60) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701505 | [INTEGRATION METHODS FOR DIFFERENTIAL EQUATIONS](#C64) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702510 | [INTERNET OF THINGS](#C139) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702510 | [Internet of Things](#C142) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701510 | [Introduction To Fixed Point Theory](#C148) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702513 | [Introduction to Generalized Metric Spaces](#C145) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702514 | [Introduction to Hyperbolic Geometry](#C146) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701511 | [Introduction to Lorentz Geometry](#C147) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701512 | [Introduction to Methods of Exact Solutions](#C143) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702504 | [LIE ALGEBRAS](#C79) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702512 | [Lie Symmetry Analysis of Fractional Order Differential Equations](#C151) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602612 | [LORENTZIAN GEOMETRY II](#C84) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601541 | [MATHEMATICAL MODELLING I](#C85) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602616 | [MATHEMATICAL MODELLING II](#C86) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702511 | [Methods of Exact Solutions](#C144) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602609 | [MINIQUATERNION GEOMETRY II](#C91) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602625 | [MOVEMENT GEOMETRY II](#C36) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701508 | [Natural Language Processing](#C149) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601530 | [NUMER. AND ANALY. SOLUT. OF THE ALGEB. EQ.](#C8) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602526 | [NUMERICAL AND ANALYTIC SOLUTIONS OF THE ALGEBRAIC EQUATION II](#C7) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601511 | [NUMERICAL METHODS FOR ODES I](#C2) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602540 | [NUMERICAL METHODS WITH MATLAB](#C87) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601545 | [NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS I](#C73) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701509 | [PHP and MVC Framework](#C150) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601504 | [PROJECTIVE GEOMETRY OF N-DIMENSIONS -I](#C95) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602505 | [PROJECTIVE GEOMETRY OF N-DIMENSIONS -II](#C97) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602535 | [REPRESENTATION THEORY I](#C100) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601524 | [RINGS AND MODULES I](#C32) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602524 | [RINGS AND MODULES II](#C33) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601618 | [SEMI-RIEMANN GEOMETRY I](#C103) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602602 | [SIMPLICIAL ALGEBRA](#C106) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601543 | [SPACELIKE HYPERSURFACES.GLOBAL DIFFERANTIAL GEOMETRY I](#C117) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501702506 | [SYMMETRY GROUPS AND CONSERVATION LAWS OF DIFFERENTIAL EQUATIONS](#C120) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601528 | [TENSOR GEOMETRY I](#C121) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602533 | [TENSOR GEOMETRY II](#C122) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501602539 | [THEORY OF GENERALIZED BILINEAR DERIVATES](#C135) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701502 | [THEORY OF ORDINARY DIFFERENTIAL EQUATIONS](#C1) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501601517 | [TRANSFORMATIONS AND GEOMETRIES I](#C16) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |
| 501701507 | [VOLTERRA-FREDHOLM INTEGRAL EQUATIONS](#C134) | 7.5 | | 3+0 | | 3 | | E | | Turkish | |

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501701502 | **TITLE** | Theory of Ordinary Differential Equations |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Theory of Ordinary Differential Equations | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to present theory of ordinary differential equations to the student who has so far seen the basic solution techniques. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics snd Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand using ordinary differential equations,  2. The existing concepts for the theoretical analysis of numerical and analytical solution of the ordinary differential equations,  3. Understanding theoritical analysis,  4. Examining Solitions. | | | | | | | |
| **TEXTBOOK** | | | | | Introduction to theoretiacl aspects of ordinary differential equations, Albert K. Erkip. | | | | | | | |
| **OTHER REFERENCES** | | | | | Theory of Ordinary Differential Equations, Earl A. Coddington and Norman Levinson. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | First order differential equations |
| 2 | First order differential equations |
| 3 | Proof of the existence-uniqueness theorem |
| 4 | Proof of the existence-uniqueness theorem |
| 5 | Systems and higher order ODE's. |
| 6 | Midterm Examination 1 |
| 7 | Systems and higher order ODE's. |
| 8 | Linear differential equations |
| 9 | Linear differential equations |
| 10 | Boundary value problems and eigenvalue problems |
| 11 | Midterm Examination 2 |
| 12 | Boundary value problems and eigenvalue problems |
| 13 | Oscillation and comparison theorems |
| 14 | Oscillation and comparison theorems |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Dursun Irk | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

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**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601511 | **TITLE** | Numerical methods for ODEs I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Numerical methods for ODEs | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main purpose of the course is to gain the numerical technique to solve the ordinary differential equations. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics snd Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Solve ordinary differential equations in various fields,  2. Learn difference equations which take an important in numerical analysis,  3. Use single-step methods in numerical solutions of differential equations,  4. Apply multi-step mehods for numerical solutions. Apply multi-step methods for numerical solutions Apply multi-step methods for numerical solutions | | | | | | | |
| **TEXTBOOK** | | | | | J. D. Lambert, Computational methods in ordinary differential equations. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic concepts |
| 2 | Difference equations |
| 3 | Taylor method |
| 4 | Runge-Kutta method |
| 5 | Exrapolation method |
| 6 | Midterm Examination 1 |
| 7 | Obrechkoff method |
| 8 | Explicit multi-step method |
| 9 | Explicit multi-step method |
| 10 | Implicit multi-step method |
| 11 | Midterm Examination 2 |
| 12 | Implicit multi-step method |
| 13 | Predictor-corrector method |
| 14 | Predictor-corrector method |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Dursun Irk | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Application of Lie groups to differential equations-I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Symmetry concept in nature, Lie theory of differential equations, prolongation of vector field, prolongation formula, group invariant solutions and generators of partial differential equations, optimal system, classification of group invariant solutions. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To introduce Lie theory of differential equations,  2. Finding the genarators of the corresponding system,  3. Finding the optimal system,  4. Finding the group invariant solutions. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Calculating the invariant group transformations using the Lie group transformations,  2. Finding the solutions of the ordinary differential equations using the one-parameter Lie group of transformations,  3. Finding the optimal systems concerned with invariant solutions,  using the package programs of finding symmetry groups,  4. Finding the symmetry solutions of Pde's. | | | | | | | |
| **TEXTBOOK** | | | | | P. J. Olver, Applications of Lie Groups to Differential Equations | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.Ibragimov, N.H. (1999). Elementary Lie Group Analysis and Ordinary Differential Equations, John Willey & Sons Ltd. 2. Ibragimov, N.H. (1994). Lie Group Analysis of Differential Equations, CRC Press. 3. Bluman, G.W. ve Kumei, S.(1989). Symmetries and Differential Equations, SpringerVerlag | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | One-Parameter transformation groups |
| 2 | PLie groups |
| 3 | Prolongation Formula |
| 4 | Determination of PDE’s invariant under a given group |
| 5 | Finding generators |
| 6 | Midterm Examination 1 |
| 7 | Notion of an invariant solution |
| 8 | Optimal Systems |
| 9 | Optimal Systems |
| 10 | Lie’s general classification and linearization |
| 11 | Midterm Examination 2 |
| 12 | Symmetry solutions of Pde's |
| 13 | Finding invariant solutions and generators using computer programs |
| 14 | Finding invariant solutions and generators using computer programs |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. Sait San | **Date:** | | 22.04.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Axiomatic Geometry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 25 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | To study on Near Linear Spaces, Linear Spaces, Generalized Quadrangles and Blocking Sets | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To give knowledge about the geometries which are outside of well-known Euclidean geometry.  2. To be able to analyse outside of well-known Euclidean geometry in terms of axiomatic | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have advanced knowlegde in private areas of geometry | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1-To be able to analyse the problem which are met in the theory of the geometries which are outside of well-known Euclidean geometry  2-To gain the ability of problem solving.  3-To relate with other fields of geometry  4-To solve the problem about the geometries which are outside of well-known Euclidean geometry. | | | | | | | |
| **TEXTBOOK** | | | | | 1- Batten, L.M. and Beutelspacher, A. , The theory of finite linear spaces, Cambridge university press, 1993.2- Batten, L.M., Combinatorics of finite geometries, Cambridge university press. 1986. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Kaya, R., Projektif Geometri, Osmangazi üniversitesi yayınları , yayın no:111, Eskişehir, 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Near Linear Spaces |
| 2 | Near Linear Spaces |
| 3 | Linear Spaces |
| 4 | Linear Spaces |
| 5 | Generalized Quadrangles |
| 6 | Midterm Examination 1 |
| 7 | Generalized Quadrangles |
| 8 | Generalized Quadrangles |
| 9 | Blocking Sets in Projective Planes |
| 10 | Blocking Sets in Projective Planes |
| 11 | Midterm Examination 2 |
| 12 | Blocking Sets in Affine Planes |
| 13 | Blocking Sets in Affine Planes |
| 14 | Applications of Blocking Sets |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Asst. Prof. Temel ERMİŞ | **Date:** | | 19.11.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601513 | **TITLE** | Initial and Boundary value problems I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Differential equations and partial derivatives equations | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Initial and Boundary value problems related with Ordinary Differential Equations and their solutions are given. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Ordinary differential equations are given about the initial and boundary value problems identified and solutions. Physics and engineering problems are discussed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Professional life gives you the ability to understand a variety of problems and problem-solving in the face of. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Initial and Boundary value problems,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Elementary Boundary Value Problems, T.A. Bick. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Summary of partial differential equations |
| 2 | Summary of partial differential equations cont. |
| 3 | Summary of partial differential equations cont. |
| 4 | Fourier series |
| 5 | Fourier series cont. |
| 6 | Midterm Examination 1 |
| 7 | Rectangular coordinates, boundary-value problems |
| 8 | Rectangular coordinates, boundary-value problems cont. |
| 9 | Rectangular coordinates, boundary-value problems cont. |
| 10 | Boundary value problems in cylindrical coordinates |
| 11 | Midterm Examination 2 |
| 12 | Boundary value problems in cylindrical coordinates cont. |
| 13 | Boundary value problems in spherical coordinates |
| 14 | Boundary value problems in spherical coordinates cont. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Dursun Eser | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602517 | **TITLE** | Initial and Boundary value problems II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Differential equations and partial derivatives equations | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Initial and boundary value problems for partial differential equations are solutions to be identified. Physics and engineering problems are discussed. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Ordinary differential equations are given about the initial and boundary value problems identified and solutions. Physics and engineering problems are discussed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Professional life gives you the ability to understand a variety of problems and problem-solving in the face of. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Initial and Boundary value problems,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Partial Differential Equations and boundary value problems, Mark A. Pinsky. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Fourier transforms |
| 2 | Fourier transforms cont. |
| 3 | Fourier transforms cont. |
| 4 | Fourier transforms cont. |
| 5 | Fourier transforms cont. |
| 6 | Midterm Examination 1 |
| 7 | Numerical Solutions |
| 8 | Numerical Solutions cont. |
| 9 | Green functions |
| 10 | Green functions cont. |
| 11 | Midterm Examination 2 |
| 12 | approximate solutions |
| 13 | approximate solutions cont. |
| 14 | approximate solutions cont. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Dursun Eser | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602526 | **TITLE** | Numerical and Analytic solutions of the algebraic equation II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Content of the course is as follows: For numerical solutions of nonlinear equation systems Newton method, steepest descent method, conjugate gradient method, conjugate direction method, preconditioned conjugate gradient method. Basic definitions and algorithms of projection methods, general projection method and its matrix representation. Krylov subspaces, Arnoldi method, Arnoldi methods of linear equation systems. Numerical obtaining of eigenvalues and eigenvectors. Rayleigh quotient iteration. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to learn the technique of numerical solution for nonlinear equations and doing error analysis. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Solve nonlinear equation systems in high accuracy,  2. Learn Krylov subspaces and methods,  3. Rercognize projection methods,  4. Stabiliy of the nonlinear algebraic equations. | | | | | | | |
| **TEXTBOOK** | | | | | 1- Kendall E. Atkinson, An introduction to numerical analysis. 2- Yousef Saad, Iterative methods for sparse linear systems. | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | For numerical solutions of nonlinear equation systems Newton method, |
| 2 | For numerical solutions of nonlinear equation systems Newton method, |
| 3 | steepest descent method, conjugate gradient method |
| 4 | steepest descent method,conjugate direction method, |
| 5 | preconditioned conjugate gradient method. |
| 6 | Midterm Examination 1 |
| 7 | Basic definitions and algorithms of projection methods, |
| 8 | Basic definitions and algorithms of projection methods, |
| 9 | general projection method and its matrix representation. |
| 10 | Krylov subspaces, Arnoldi method, |
| 11 | Midterm Examination 2 |
| 12 | Arnoldi methods of linear equation systems. |
| 13 | Numerical obtaining of eigenvalues and eigenvectors. |
| 14 | Rayleigh quotient iteration |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. İdris Dağ | **Date:** | | 13.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601530 | **TITLE** | Numer. and Analy. Solut. of the Algeb. Eq. |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Numer. and Analy. Solut. of the Algeb. Eq. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to learn the technique to solve numerical solution of nonlinear equations and doing error analysis of the technique. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics snd Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Understand the basic concepts of linear algebra,  2. Find root of nonlinear equations,  3. Learn the basic iterative methods for systems of equations,  4. Apply convergence analysis to basic iteratives methods. Apply convergence analysis to basic iterative methods. | | | | | | | |
| **TEXTBOOK** | | | | | Kendall E. Atkinson, An introduction to numerical analysis. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | For root finding of nonlinear equations bisection method |
| 2 | Newton’s method |
| 3 | Secant method, a general theory for one-point iteration method |
| 4 | Roots of polynomials, systems nonlinear equations |
| 5 | Newton’s method for nonlinear equations |
| 6 | Midterm Examination 1 |
| 7 | Vector spaces, matrices, and linear systems |
| 8 | Vector inner product, norms, matrix norms |
| 9 | Canonical forms of matrices |
| 10 | Eigenvalues and eigenvectors, normal and hermitian matrices, convergence and perturbation theorem |
| 11 | Midterm Examination 2 |
| 12 | Variants of gaussian elimination, error analysis. |
| 13 | Basic iterative methods: Jacobi, Gauss-Seidel, Sor methods and their convergence |
| 14 | Application of the basic iterative systems: discretization of PDEs |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Dursun Irk | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601527 | **TITLE** | Algebraic Topology I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Topological Spaces, Continuous Functions, Induced Topology, Quotient Topology, Compact Spaces, Hausdorff Spaces. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to introduce students to homotopy and fundamental groups structure. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand the Topological Spaces,  2. Understand the Continuos Functions,  3. Understand the Induced Topology,  4. Understand the Quotient Topology,  5. Understand the Compact Spaces and Hausdorff Spaces. | | | | | | | |
| **TEXTBOOK** | | | | | Kosniowski, Csez, (1980) A First Course in Algebraic Topology. | | | | | | | |
| **OTHER REFERENCES** | | | | | Munkres R.M. (2000). Topology.   Massey, W.S ( 1967). Algebraic Topology, Springer-Verlag. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Topological Spaces |
| 2 | Topological Spaces |
| 3 | Continuous Functions |
| 4 | Continuous Functions |
| 5 | Induced Topology |
| 6 | Midterm Examination 1 |
| 7 | Induced Topology |
| 8 | Quotient Topology |
| 9 | Quotient Topology |
| 10 | Compact Spaces |
| 11 | Midterm Examination 2 |
| 12 | Compact Spaces |
| 13 | Haussdorff Spaces |
| 14 | Haussdorff Spaces |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. İ. İlker AKÇA | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602522 | **TITLE** | Algebraic Topology II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Connected spaces, Path connected spaces, Homotopy, Fundamental Groups. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to introduce students to homotopy and fundamental groups structure. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand the connected spaces, Understand the connected spaces,  2. Understand the path connected spaces, Understand the path connected spaces,  3. Understand the homotopy theory, Understand the homotopy theory,  4. Understand the Fundamental Group structure. | | | | | | | |
| **TEXTBOOK** | | | | | Kosniowski, Csez, (1980) A First Course in Algebraic Topology. | | | | | | | |
| **OTHER REFERENCES** | | | | | Munkres R.M. (2000). Topology.   Massey, W.S ( 1967). Algebraic Topology, Springer-Verlag | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Connected Spaces |
| 2 | Connected Spaces |
| 3 | Connected Spaces |
| 4 | Path Connected Spaces |
| 5 | Path Connected Spaces |
| 6 | Midterm Examination 1 |
| 7 | Path Connected Spaces |
| 8 | Homotopy |
| 9 | Homotopy |
| 10 | Homotopy |
| 11 | Midterm Examination 2 |
| 12 | Fundamental Groups |
| 13 | Fundamental Groups |
| 14 | Fundamental Groups |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. İ. İlker AKÇA | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602537 | **TITLE** | CoCoA Programming |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Rings, polynomial rings, the division algorithm, Grobner bases, algebras, CoCoA (Computations in Commutative Algebra) system, CoCoA interface, CoCoA programming language, language elements, user-defined functions, memory management, CoCoA packages and create new package, numbers and list systems in CoCoA, functions for Grobner bases, CoCoA working system. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The understanding and application the notions of the CoCoA working system, Programming language and Grobner bases. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply knowledge of basic mathematics,  2. Know and apply Grobner bases,  3. Know and apply CoCoA programming language,  4. Know and apply CoCoA share package. | | | | | | | |
| **TEXTBOOK** | | | | | CoCoA reference manual. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. CoCoA reference manual, 2. Computational Commutative Algebra 1, M. Kreuzer, L. Robbiano , Springer (2000), ISBN 3-540-67733-X. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Rings, polynomial rings, the division algorithm |
| 2 | Grobner bases, algebras |
| 3 | CoCoA (Computations in Commutative Algebra) system |
| 4 | CoCoA interface |
| 5 | CoCoA programming language |
| 6 | Midterm Examination 1 |
| 7 | Language elements |
| 8 | User-defined functions |
| 9 | Memory management |
| 10 | CoCoA packages and create new package |
| 11 | Midterm Examination 2 |
| 12 | Numbers and list systems in CoCoA |
| 13 | Functions for Grobner bases |
| 14 | CoCoA working system |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Ass. Prof. Alper ODABAŞ | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601506 | **TITLE** | Commutative Algebras I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 40 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Conmutatives Algebras, detailed specifications. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Presenting main concepts and techniques in the content of the lesson, improving students’ Commutatives Algebras knowledge by practising these concepts and techniques. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Commutatives algebras,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Introduction to Commutative Algebra M.F.ATIYAH FRS, I.G. MACDONALD. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Ring and Ideals |
| 2 | Ring and Ideals |
| 3 | Modules |
| 4 | Modules |
| 5 | Modules |
| 6 | Midterm Examination 1 |
| 7 | Ring and Modules Fractions |
| 8 | Ring and Modules Fractions |
| 9 | Chain Conditions |
| 10 | Chain Conditions |
| 11 | Midterm Examination 2 |
| 12 | Noeterian Rings |
| 13 | Noeterian Rings |
| 14 | Noeterian Rings |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | : Assoc. Prof. Enver Önder USLU | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601502 | **TITLE** | Differentiable Manifolds I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkısh |
| **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 | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 40 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Topological Background,differentiable Manifolds,the Topology of a Manifold,differentation on a Manifold,Submanifolds,Quotient Manifolds, Vector Fields. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Be to giving base concept of Differentiable Manifolds theory,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To gain analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Brickell, F. and Clarck, S., Differentiable Manifolds, van Nostrand Reinhold Company. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Hacısalihoğlu, H. H.(1993), Diferensiyel Geometri, Cilt I, A. Ü. Fen Fakültesi Yayınları. 2. Hacısalihoğlu, H. H.(1994), Diferensiyel Geometri, Cilt II, A. Ü. Fen Fakültesi Yayınları. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Topological Background |
| 2 | Topological Background |
| 3 | Differentiable Manifolds |
| 4 | Differentiable Manifolds |
| 5 | The Topology of a Manifold |
| 6 | Midterm Examination 1 |
| 7 | Differentation on a Manifold |
| 8 | Differentation on a Manifold |
| 9 | Submanifolds |
| 10 | Submanifolds |
| 11 | Midterm Examination 2 |
| 12 | Quotient Manifolds |
| 13 | Quotient Manifolds |
| 14 | Vector Fields |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ali Görgülü | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602503 | **TITLE** | Differentiable Manifolds II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkısh |
| **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 | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 40 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Differantiel equations of first order,Linear connections,Differantiel equations of second order,Distributions,Lie groups, Lie transformation groups. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to giving base concept of Differentiable Manifolds theory. To have skill of the problem analysis and solution. To gain analytical thinking, discussion and evaluation. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Be to giving base concept of Differentiable Manifolds theory,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To gain analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Brickell, F. and Clarck, S., Differentiable Manifolds, van Nostrand Reinhold Company. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Hacısalihoğlu, H. H.(1993), Diferensiyel Geometri, Cilt I, A. Ü. Fen Fakültesi Yayınları. 2. Hacısalihoğlu, H. H.(1994), Diferensiyel Geometri, Cilt II, A. Ü. Fen Fakültesi Yayınları. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Differantiel equations of first order |
| 2 | Linear connections |
| 3 | Differantiel equations of second order |
| 4 | Distributions |
| 5 | Distributions |
| 6 | Midterm Examination 1 |
| 7 | Lie groups |
| 8 | Lie groups |
| 9 | Lie groups |
| 10 | Lie groups |
| 11 | Midterm Examination 2 |
| 12 | Lie transformation groups |
| 13 | Lie transformation groups |
| 14 | Lie transformation groups |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ali Görgülü | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601517 | **TITLE** | Transformations and Geometries I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 25 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | none | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Affine spaces, Euclidean spaces, Introduction to transformations, Transformations of similarity. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to examine carefully the affine and Euclidean spaces based on the vector theory and to give a general introduction to the transformations. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Sciense | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Use the translations in the geometry,  2.Determine which of new geometries or systems are constructable by using translations,  3.Function on multi-disciplinary teams,  4.Define problems about the theme, find the formula and solve them. | | | | | | | |
| **TEXTBOOK** | | | | | Hacısalihoğlu,H. H. İki ve Üç Boyutlu Uzaylarda Dönüşümler ve Geometriler, Ankara Üniversitesi Fen Fakültesi, Matematik Bölümü,1998. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Hacısalihoğlu, H.H. Diferensiyel Geometri, Ankara Üniversitesi Fen Fakültesi, Matematik Bölümü,2000.2-Hacısalihoğlu, H.H. Lineer cebir, Ankara Üniversitesi Fen Fakültesi, Matematik Bölümü,2000. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Affine spaces |
| 2 | Affine spaces |
| 3 | Euclidean spaces |
| 4 | Euclidean spaces |
| 5 | Euclidean spaces |
| 6 | Midterm Examination 1 |
| 7 | Introduction to transformations |
| 8 | Motions on Euclidean spaces |
| 9 | Motions on Euclidean spaces |
| 10 | Motions on Euclidean spaces |
| 11 | Midterm Examination 2 |
| 12 | Transformations of similarity |
| 13 | Transformations of similarity |
| 14 | Transformations of similarity |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. MÜNEVVER ÖZCAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601626 | **TITLE** | Differantial Geometry of curves and surfaces I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Curves, the frenet formulas, connections forms geometric surfaces | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Students will have informations introduction relation curves ans surfaces. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students will have informations introduction relation curves ans surfaces. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of curves and surfaces,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | M Da Carmo, Differential geometry of curves and surface. | | | | | | | |
| **OTHER REFERENCES** | | | | | Barret O ' Neill, Differential Geometry curves in . | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Curves in E^3 |
| 2 | Differential forms |
| 3 | The Frenet formulas |
| 4 | Arbitrary speed curvescovariant derivatives |
| 5 | Frame fields |
| 6 | Midterm Examination 1 |
| 7 | connections forms |
| 8 | the structural equations |
| 9 | Gauss Bonnet Theorem |
| 10 | Total curvature |
| 11 | Midterm Examination 2 |
| 12 | congruence of surface |
| 13 | geometric surfaces |
| 14 | exercises |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Nevin Gürbüz | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602638 | **TITLE** | Differantial geometry of curves and surfaces I I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Congruence of curves, surfaces in R^3, patch computations, normal curvature, surface of revolution. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To be learn curves and surfaces. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students will have informations introduction relation curves ans surfaces . | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of curves and surfaces,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | M Da Carmo, Differential geometry of curves and surface. | | | | | | | |
| **OTHER REFERENCES** | | | | | Barret O ' Neill, Differential Geometry curves in . | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | surfaces in R^3 |
| 2 | Mapping of surfaces |
| 3 | topological properties of surfaces |
| 4 | the shape operator |
| 5 | Normal curvature |
| 6 | Midterm Examination 1 |
| 7 | Gaussian curvature |
| 8 | surface of revolution |
| 9 | topological properties of surfaces |
| 10 | Special curves in a surface |
| 11 | Midterm Examination 2 |
| 12 | exercises |
| 13 | minimal surfaces |
| 14 | exercises |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Nevin Gürbüz | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The fundamental concepts and applications of all areas in mathematics and computer science. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Teaching basic concepts for master education. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of the course students should be able to:  1. Apply knowledge of basic mathematics,  2. Ability of searching information related area,  3. Ability to develop new and original ideas and methods,  4. Ability of finding the techniques necessary for the study field. | | | | | | | |
| **TEXTBOOK** | | | | | None | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Techniques of proof |
| 2 | Sets, relations, functions, operation |
| 3 | Algebraic concepts, groups and rings |
| 4 | Field, Vector spaces and algebras |
| 5 | Metric Spaces, Basic definitions and examples |
| 6 | Midterm Examination 1 |
| 7 | Topological Spaces, Bases and Continuity |
| 8 | Hausdorff Space, Related and compact spaces |
| 9 | Mean-value, Weierstrass Theorems |
| 10 | Limit, continuity and applications |
| 11 | Midterm Examination 2 |
| 12 | Differantiation, Integral and applications |
| 13 | Differential equations and solutions, first order differential equations and applications |
| 14 | Higher order differential equaitons, Power series and special functions |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501702502 | **TITLE** | Functional approximation theory II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Applied Functional Analysis . | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to learn the concept of functional analysis and application of functional analysis. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics snd Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Learn elementary topics in topology,  2. Know basic concepts of functional analysis,  3. Understand topological substructure of applied mathematics subjects,  4. Learning of functional operator in applied science. | | | | | | | |
| **TEXTBOOK** | | | | | J. Tinsley Oden and Leszek F. Demkowicz, Applied functional analysis. | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Elementary topology, continuity and compactness |
| 2 | Sequences, topological equivalence, metric spaces and normed spaces |
| 3 | Topological properties of metric spaces |
| 4 | Topological vector spaces |
| 5 | Hahn-Banach theorem, Hahn-Banach extension theorem |
| 6 | Midterm Examination 1 |
| 7 | Continious linear operators and normed spaces |
| 8 | Open mapping theorems, closed operators, topological duals |
| 9 | Solvability of linear equations, inner product spaces and Hilbert spaces |
| 10 | Orthogonality and ortogonal projections, orthonormal bases and Fourier series |
| 11 | Midterm Examination 2 |
| 12 | Duality in Hilbert spaces, adjoint of a linear operator, variational boundary value problems |
| 13 | Generalize Green’s formulae for operators on Hilbert spaces |
| 14 | Spectral theory for compact operators, spectral theory for self-adjoint operators |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. İdris Dağ | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501702501 | **TITLE** | Generalized Quadrangles I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Generalized quadrangles, finite generalized quadrangles, translations in generalized quadrangles, generalized guadrangles in projective space. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | In this lecture our aim is to give generalized quadrangles and generalized quadrangles in finite projective space. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advance knowledge about a subdomain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Function on multi-disciplinary teams,  2. Identify, formulate and solve mathematical problems,  3. Gain a knowledge of contemporary issues,  4. Full attendance throughout the semester facilities,  5. Fulfillment of assignet tasks and term papers, use of library and computer-based facilities. | | | | | | | |
| **TEXTBOOK** | | | | | J. A. Thas, K. Thas, H. Van Maldeghem, Translation Generalized Quadrangles, Series in Pure Mathematics Volume 26, Vorld Scientific. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Generalized quadrangles |
| 2 | Generalized quadrangles |
| 3 | Finite generalized quadrangles |
| 4 | Finite generalized quadrangles |
| 5 | Finite generalized quadrangles |
| 6 | Midterm Examination 1 |
| 7 | Finite generalized quadrangles |
| 8 | Finite generalized quadrangles |
| 9 | Finite generalized quadrangles |
| 10 | Finite generalized quadrangles |
| 11 | Midterm Examination 2 |
| 12 | Generalized guadrangles in projective space |
| 13 | Generalized guadrangles in projective space |
| 14 | Generalized guadrangles in projective space |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. ZİYA AKÇA | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601525 | **TITLE** | Group Theory I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 60 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Semigroups, monoids and groups, subgroups, cyclic groups, cosets, stabilizers, normalizers, orbits, centralizers, normal subgroups, quotient groups, homomorphisms, isomorphism theorems, automorphism groups, symmetric, alternating and dihedral groups, group actions and permutation representations, Cayley’s theorem. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to give informations about fundamental group theory. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand basic concepts of semigroups and subgroups, Understand basic concepts of Lattice theory,  2. Understand normal groups, Understand projective geometries and projective lattices,  3. Have knowledge about homomorphism and isomorfizm theorems, Have knowledge about degree of n geometries,  4. Learn automorphism groups. Learn transformations of projective geometry Understand various geometric structure which satisfy axioms of Euclidean geometry | | | | | | | |
| **TEXTBOOK** | | | | | W. A. Adkins, S. H. Weintraub Algebra, An Approach via Module Theory. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. K. Spindler, Abstract algebra with applications. 2. T. Hungerford, Algebra. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Semigroups |
| 2 | Monoids and groups |
| 3 | Subgroups |
| 4 | Cyclic groups |
| 5 | Cosets |
| 6 | Midterm Examination 1 |
| 7 | Stabilizers, normalizers, orbits, centralizers |
| 8 | Normal subgroups |
| 9 | Quotient groups |
| 10 | Homomorphisms, isomorphism theorems |
| 11 | Midterm Examination 2 |
| 12 | Automorphism groups |
| 13 | Symmetric, alternating and dihedral groups |
| 14 | Group actions and permutation representations, cayley’s theorem |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. UMMUHAN EGE ARSLAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602523 | **TITLE** | Group Theory II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 50 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Sylow’s Theorems, Direct sums, Direct and semidirect products, free groups, free products, generators, nilpotent and solvable groups. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to give informations about fundamental group theory. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand basic concepts of Sylow's theorem, direct sums and direct products, Understand basic concepts of Lattice theory,  2. Understand free groups, Understand projective geometries and projective lattices,  3. Have knowledge about free products, Have knowledge about degree of n geometries,  4. Learn generators, nilpotent and solvable groups. Learn transformations of projective geometry Understand various geometric structure which satisfy axioms of Euclidean geometry | | | | | | | |
| **TEXTBOOK** | | | | | W. A. Adkins, S. H. Weintraub Algebra, An Approach via Module Theory. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. K. Spindler, Abstract algebra with applications. 2. T. Hungerford, Algebra. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Sylow’s Theorems |
| 2 | Sylow’s Theorems |
| 3 | Direct sums |
| 4 | Direct and semidirect products |
| 5 | Direct and semidirect products |
| 6 | Midterm Examination 1 |
| 7 | Free groups |
| 8 | Free groups |
| 9 | Free products |
| 10 | Free products |
| 11 | Midterm Examination 2 |
| 12 | Generators, nilpotent and solvable groups |
| 13 | Generators, nilpotent and solvable groups |
| 14 | Generators, nilpotent and solvable groups |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. UMMUHAN EGE ARSLAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601524 | **TITLE** | Rings and Modules I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 70 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Ideals, quotient rings, isomorphism theorems, quotient fields, localization, local rings, principal ideal domains, Euclidean domains, prime factorization, modules, chain conditions, Noetherian rings. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To obtain informations about fundamental ring and module. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand basic concepts of ideals and quotient rings, Understand basic concepts of Lattice theory,  2. Understand isomorphism theorems, Understand projective geometries and projective lattices,  3. Have knowledge about lokal rings, Have knowledge about degree of n geometries,  4. Learn noetherian rings. Learn transformations of projective geometry Understand various geometric structure which satisfy axioms of Euclidean geometry | | | | | | | |
| **TEXTBOOK** | | | | | Algebra (An approach via module theory), William A. Adkins, Steven H. Weintraub. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Steps in commutative algebra, R.Y. Sharp. 2. Algebra, Thomas W. Hungerford. 3. An introduction to homological algebra, Joseph J. Rotman. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Ideals, quotient rings |
| 2 | Isomorphism theorems |
| 3 | Isomorphism theorems |
| 4 | Quotient fields, localization |
| 5 | Quotient fields, localization |
| 6 | Midterm Examination 1 |
| 7 | Local rings |
| 8 | Principal ideal domains |
| 9 | Euclidean domains |
| 10 | Prime factorization, modules, chain conditions |
| 11 | Midterm Examination 2 |
| 12 | Noetherian rings |
| 13 | Noetherian rings |
| 14 | Noetherian rings |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. UMMUHAN EGE ARSLAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602524 | **TITLE** | Rings and Modules II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 70 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Modules, submodules, quotient modules, direct sums, direct summand exact sequences, free modules, free resolution, projective modules, injective modules and injective resolution, bilineer and quadratic forms. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To obtain informations about fundamental ring and module. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand basic concepts of modules and submodules, Understand basic concepts of Lattice theory,  2. Understand free modules, Understand projective geometries and projective lattices,  3. Have knowledge about free resolution, Have knowledge about degree of n geometries,  4. Learn bilineer and quadratic forms. Learn transformations of projective geometry Understand various geometric structure which satisfy axioms of Euclidean geometry | | | | | | | |
| **TEXTBOOK** | | | | | Algebra (An approach via module theory), William A. Adkins, Steven H. Weintraub. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Steps in commutative algebra, R.Y. Sharp. 2. Algebra, Thomas W. Hungerford. 3. An introduction to homological algebra, Joseph J. Rotman. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Modules |
| 2 | Submodules |
| 3 | Quotient modules |
| 4 | Direct sums, direct summand exact sequences |
| 5 | Free modules |
| 6 | Midterm Examination 1 |
| 7 | Free resolution |
| 8 | Projective modules |
| 9 | İnjective modules and injective resolution |
| 10 | İnjective modules and injective resolution |
| 11 | Midterm Examination 2 |
| 12 | Bilineer and quadratic forms |
| 13 | Bilineer and quadratic forms |
| 14 | Bilineer and quadratic forms |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. UMMUHAN EGE ARSLAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602625 | **TITLE** | MOVEMENT GEOMETRY II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | 1- Subjects such as canonical relation system,  2- K/K' unit dual spherical motion,  3- Theory of ruled surfaces,  4- Closed ruled surface and its integral invariants,  5- The pitch and the angle of pitch of a closed ruled surface,  6- Dual pitch angle and generalizations in space of lines are studied. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Subjects such as canonical relation system, K/K' unit dual spherical motion, theory of ruled surfaces, closed ruled surface and its integral invariants, the pitch and the angle of pitch of a closed ruled surface, dual pitch angle and generalizations in space of lines are studied. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply knowledge of basic mathematics,  2. Conduct applications as well as to analyze and interpret data,  3. Function on multi-disciplinary teams,  4. Identify, formulate, and solve mathematical problems,  5. Computer, software as contemporary methods, techniques apply to mathematics,  6. Communicate effectively,  7. Understand the broad education necessary to understand the impact of mathematical solutions in a global and societal context,  8. Get a recognition of the need for, and an ability to engage in life-long learning,  9. Gain a knowledge of contemporary issues,  10. Develop a research skills for their dissertatio. | | | | | | | |
| **TEXTBOOK** | | | | | 1- Müller, H. R., Kinematik Dersleri, Ankara Üniversitesi Yayınları, (1963). 2- Biran, L., Kinematik, İstanbul Üniversitesi yayınları, 1949.  3- Hacısalihoğlu, H. H., Diferensiyel Geometri, Cilt I-II, Ankara, 2004.  4- Hacısalihoğlu H. H., Hareket Geometrisi ve Kuaternionlar Teorisi, Ankara, 1983. 5- R. Kaya, Lineer Cebir (Redaksiyon), Eskişehir, (2000). | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Subjects such as canonical relation system, |
| 2 | Subjects such as canonical relation system, |
| 3 | K/K' unit dual spherical motion, |
| 4 | K/K' unit dual spherical motion, |
| 5 | theory of ruled surfaces, |
| 6 | Midterm Examination 1 |
| 7 | theory of ruled surfaces, |
| 8 | closed ruled surface and its integral invariants, |
| 9 | closed ruled surface and its integral invariants, |
| 10 | the pitch and the angle of pitch of a closed ruled surface, |
| 11 | Midterm Examination 2 |
| 12 | the pitch and the angle of pitch of a closed ruled surface, |
| 13 | dual pitch angle and generalizations in space of lines are studied |
| 14 | dual pitch angle and generalizations in space of lines are studied |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Cumali Ekici | **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** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501702503 | **TITLE** | Algebra with Haskell |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Haskell programming language, Types and Typeclasses, Syntax in Functions, Recursion, Higher Order Functions, Modules, Input and Output, Functionally Solving Problems, Functors and Monoids, Monads, Haskell and Category Theory. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The understanding and application the notions of the Haskell working system and Programming language. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Know and apply Haskell program language,  2. Know and apply Haskell modules,  3. Writing a Haskell package,  4. Understanding a functional programming notions. Know and apply Haskell modules.Please write minimum four learning outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | Real World Haskell, Bryan O'Sullivan, J. Goerzen, Donald Bruce Stewart, O'Reilly Media (2008), ISBN 9780596514983. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Real World Haskell, Bryan O'Sullivan, J. Goerzen, Donald Bruce Stewart, O'Reilly Media (2008), ISBN 9780596514983.  2. Haskell, The Craft of Functional Programming, Simon Thompson Addison-Wesley, ISBN 0-201-34275-8. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Haskell programming language |
| 2 | Types and Typeclasses |
| 3 | Syntax in Functions |
| 4 | Recursion, Higher Order Functions |
| 5 | Modules, Input and Output |
| 6 | Midterm Examination 1 |
| 7 | Functionally Solving Problems |
| 8 | Functors and Monoids |
| 9 | Monads |
| 10 | Haskell and Category Theory |
| 11 | Midterm Examination 2 |
| 12 | Haskell and Category Theory |
| 13 | Haskell and Category Theory |
| 14 | Haskell and Category Theory |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. Ahmet Faruk ASLAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601523 | **TITLE** | Hiperbolic Geometry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | A brief history of Euclidean Geomery, Euclidean rigid motions, Euclidean rigid motions and absolute geometry, Inversions, Hyperbolic plane, Hyperbolic distance, hyperbolic lines, Hyperbolic angles, Hyperbolic rigid motions, Euclidean Versus hyperbolic geometry. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to introduce students to have basic informations about The upper half- plane model of the hyperbolic plane. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advance knowledge about a subdomain of mathematics and computer sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1- Be familiar with the concept of the hyperbolic plane,  2- Know inversions the basic properties of inversions,  3- Learn the upper-half plane model,  4- Know Hyperbolic distance, hyperbolic lines, Hyperbolic angles, Hyperbolic rigid motions and applications of these subject,  5- Compare Euclidean and hyperbolic geometry. | | | | | | | |
| **TEXTBOOK** | | | | | Saul Stahl,(1993), The Poincare Half-Plane. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | A brief history of Euclidean Geomery |
| 2 | A brief history of Euclidean Geomery |
| 3 | Euclidean rigid motions |
| 4 | Euclidean rigid motions and absolute geometry |
| 5 | Inversions |
| 6 | Midterm Examination 1 |
| 7 | Inversions |
| 8 | Hyperbolic plane |
| 9 | Hyperbolic distance |
| 10 | Hyperbolic lines |
| 11 | Midterm Examination 2 |
| 12 | Hyperbolic angles |
| 13 | Hyperbolic rigid motions |
| 14 | Euclidean versus Hyperbolic Geometry. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ayşe Bayar | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602520 | **TITLE** | Hiperbolic Geometry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Hyperbolic triangle, the angles of the hyperbolic triangle, hyperbolic area, the area of the hyperbolic, the trigonometry of the hyperbolic triangles. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to introduce students to have basic subjects in the upper half- plane model of the hyperbolic plane. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advance knowledge about a subdomain of mathematics and computer sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Be familiar with the concept of the hyperbolic triangle, the angles of the hyperbolic triangle,  2. Hyperbolic and understand the geometrical importance,  3. Calculate the area of the hyperbolic triangle,  4. Learn the the trigonometry of the hyperbolic triangle. | | | | | | | |
| **TEXTBOOK** | | | | | Saul Stahl,(1993), The Poincare Half-Plane. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Hyperbolic triangle |
| 2 | Hyperbolic triangle |
| 3 | The angles of the hyperbolic triangle |
| 4 | The angles of the hyperbolic triangle |
| 5 | Hyperbolic area |
| 6 | Midterm Examination 1 |
| 7 | Hyperbolic area |
| 8 | Hyperbolic area |
| 9 | The area of the hyperbolic triangle |
| 10 | The area of the hyperbolic triangle |
| 11 | Midterm Examination 2 |
| 12 | The area of the hyperbolic triangle |
| 13 | The trigonometry of the hyperbolic triangles |
| 14 | The trigonometry of the hyperbolic triangles |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ayşe Bayar | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601621 | **TITLE** | Homotopical Algebra |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Homotopy, Fundamental Groups, Simplicial Complexes, CW Complexes, Homology. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Give some homotopical aspects. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply knowledge of basic mathematics, Apply knowledge of basic mathematics,  2. Understanding the construction of homotopy, Understanding the construction of categories,  3. Know fundamental groups, Know functors, natural transformation and functor category  4. Know and apply simplicial complex and CW complex, Know and apply universals and limits,  5. Know and apply homology. | | | | | | | |
| **TEXTBOOK** | | | | | Brayion Gray, Homotopy Theory. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Homotopy |
| 2 | Homotopy |
| 3 | Fundamental Group |
| 4 | Calculating the Fundamental Group |
| 5 | Simplicial Complexes |
| 6 | Midterm Examination 1 |
| 7 | Simplicial Complexes |
| 8 | CW Complexes |
| 9 | CW Complexes |
| 10 | CW Complexes |
| 11 | Midterm Examination 2 |
| 12 | Homology |
| 13 | Homology |
| 14 | Homology |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. Ahmet Faruk ASLAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601521 | **TITLE** | Advanced Differential Geometry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Examples of Hypersurfaces,Ruled surfaces,Parallel Hypersurfaces,Riemannian Manifolds and lenght, distance,Riemannian Connection and Curvature,Curvatures on Riemannian Manifolds. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to introduce students; Examples of Hypersurfaces, Ruled surfaces, Parallel Hypersurfaces, Riemannian Manifolds and lenght, distance, Riemannian Connection and Curvature and Curvatures on Riemannian Manifolds. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply knowledge of basic mathematics,  2. Conduct applications as well as to analyze and interpret data,  3. Function on multi-disciplinary teams,  4. Identify, formulate, and solve mathematical problems,  5. Computer, software as contemporary methods, techniques apply to mathematics,  6. Communicate effectively,  7. Understand the broad education necessary to understand the impact of mathematical solutions in a global and societal context,  8. Get a recognition of the need for, and an ability to engage in life-long learning,  9. Gain a knowledge of contemporary issues,  10. Develop a research skills for their dissertation. | | | | | | | |
| **TEXTBOOK** | | | | | B. O'Neill, Elementary Differential Geometry, Academic Press Inc., London (1966). | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Hacısalihoğlu, H. H., Diferensiyel Geometri, Cilt I, Ankara Üniversitesi, Fen Fakültesi Yayınları, 1998.  2- Hacısalihoğlu H. H., Diferensiyel Geometri, Cilt II, Ankara Üniversitesi, Fen Fakültesi Yayınları, 2000. 3- Hacısalihoğlu H. H., Diferensiyel Geometri, Cilt III, Ankara Üniversitesi, Fen Fakültesi Yayınları, 2004. 4- Sabuncuoğlu, A., Diferensiyel Geometri, Nobel Yayınevi, 2001. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Examples of Hypersurfaces |
| 2 | Examples of Hypersurfaces |
| 3 | Ruled Hypersurfaces |
| 4 | Ruled Hypersurfaces |
| 5 | Parallel Hypersurfaces |
| 6 | Midterm Examination 1 |
| 7 | Riemannian Manifolds and lenght, distance |
| 8 | Riemannian Manifolds and lenght, distance |
| 9 | Riemannian Connection and Curvature |
| 10 | Riemannian Connection and Curvature |
| 11 | Midterm Examination 2 |
| 12 | Curvatures on Riemannian Manifolds. |
| 13 | Curvatures on Riemannian Manifolds. |
| 14 | Curvatures on Riemannian Manifolds. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Cumali Ekici | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602518 | **TITLE** | Advanced Differential Geometry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 25 |
| Quiz | | | | | 1 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Connection and invariant,Connection and Cartan equations,integration on vectors ,fundamental concept for theory of integration ,Fubini Theorem and change value ,Gauss-Bonnet Theory,Euler-Poincare charactericstic. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to introduce students; Connection and invariants, Connection and Cartan equations, integration on vectors, Fundamental concept for theory of integration, Fubini Theorem and change value and Gauss-Bonnet Theory ve Euler-Poincare charactericstic. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply knowledge of basic mathematics, Apply knowledge of basic mathematics,  2. Conduct applications as well as to analyze and interpret data, Conduct applications as well as to analyze and interpret data  3. Function on multi-disciplinary teams, Function on multi-disciplinary teams  4. Identify, formulate, and solve mathematical problems, Identify, formulate, and solve mathematical problems  5. Computer, software as contemporary methods, techniques apply to mathematics, Computer, software as contemporary methods, techniques apply to mathematics Computer, software as contemporary methods, techniques apply to mathematics Computer, software as contemporary methods, techniques apply to mathematics  6. Communicate effectively, Communicate effectively  7. Understand the broad education necessary to understand the impact of mathematical solutions in a global and societal context, Understand the broad education necessary to understand the impact of mathematical solutions in a global and societal context  8. Get a recognition of the need for, and an ability to engage in life-long learning, Get a recognition of the need for, and an ability to engage in life-long learning  9. Gain a knowledge of contemporary issues, Gain a knowledge of contemporary issues  10. Develop a research skills for their dissertation. Develop a research skills for their dissertation Develop a research skills for their dissertation Develop a research skills for their dissertation. | | | | | | | |
| **TEXTBOOK** | | | | | 1- B. O'Neill, Elementary Differential Geometry, Academic Press Inc., London (1966). 1- B. O'Neill, Elementary Differential Geometry, Academic Press Inc., London (1966). 1- B. O'Neill, Elementary Differential Geometry, Academic Press Inc., London (1966). | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Hacısalihoğlu, H. H., Diferensiyel Geometri, Cilt I, Ankara Üniversitesi, Fen Fakültesi Yayınları.  2- Hacısalihoğlu H. H., Diferensiyel Geometri, Cilt II, Ankara Üniversitesi, Fen Fakültesi Yayınları, 2000. 3- Hacısalihoğlu H. H., Diferensiyel Geometri, Cilt III, Ankara Üniversitesi, Fen Fakültesi Yayınları, 2004. 4- Sabuncuoğlu, A., Diferensiyel Geometri, Nobel Yayınevi, 2001. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Connection and invariants |
| 2 | Connection and Cartan equations |
| 3 | integration on vectors |
| 4 | Fundamental concept for theory of integration |
| 5 | Fundamental concept for theory of integration |
| 6 | Midterm Examination 1 |
| 7 | Fubini Theorem and change value |
| 8 | Fubini Theorem and change value |
| 9 | Fubini Theorem and change value |
| 10 | Gauss-Bonnet Theory |
| 11 | Midterm Examination 2 |
| 12 | Gauss-Bonnet Theory |
| 13 | Euler-Poincare charactericstic |
| 14 | Euler-Poincare charactericstic |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Cumali Ekici | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601534 | **TITLE** | Advanced Linear Geometry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | 1. Affine and projective spaces,  2. Designs,  3. Semiaffine linear spaces. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to obtain information about Linear Geometry. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advance knowledge about a subdomain of mathematics and computer sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Learn Affine spaces,  2. Learn projective spaces,  3. Learn Designs,  4. Learn Semiaffine linear spaces. | | | | | | | |
| **TEXTBOOK** | | | | | Lynn Margaret Batten, The Theory of Finite Linear Spaces. Rafael ARTZY,Lineer Geometry. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Affine spaces |
| 2 | Affine spaces |
| 3 | Affine spaces |
| 4 | Projective spaces |
| 5 | Projective spaces |
| 6 | Midterm Examination 1 |
| 7 | Projective spaces |
| 8 | Designs |
| 9 | Designs |
| 10 | Designs |
| 11 | Midterm Examination 2 |
| 12 | Semiaffine linear spaces |
| 13 | Semiaffine linear spaces |
| 14 | Semiaffine linear spaces |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ayşe Bayar | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602529 | **TITLE** | Advanced Linear Geometry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Learn Linear Spaces, Embedding linear spaces, Group action on linear spaces. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to obtain information about Linear Geometry. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advance knowledge about a subdomain of mathematics and computer sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Function on multi-disciplinary teams,  2. Linear Spaces,  3. Embedding linear spaces,  4. Group action on linear spaces. | | | | | | | |
| **TEXTBOOK** | | | | | Lynn Margaret Batten, The Theory of Finite Linear Spaces, Rafael ARTZY,Lineer Geometry. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Linear Spaces |
| 2 | Linear Spaces |
| 3 | Linear Spaces |
| 4 | Linear Spaces |
| 5 | Embedding linear spaces |
| 6 | Midterm Examination 1 |
| 7 | Embedding linear spaces |
| 8 | Embedding linear spaces |
| 9 | Embedding linear spaces |
| 10 | Group action on linear spaces |
| 11 | Midterm Examination 2 |
| 12 | Group action on linear spaces |
| 13 | Group action on linear spaces |
| 14 | Group action on linear spaces |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ayşe Bayar | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601512 | **TITLE** | Advanced Numerical Analysis I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Linear spaces, linear operators on norm spaces, approximation theory, nonlinear equations and their solution by iteration, solution of systems of linear equations, special matrices, eigenvalues and eigenvectors of a symmetric matrix, polynomial interpolation, numerical integration, polynomial approximation, Initial value problems for ODEs, boundary value problems for ODEs, finite difference methods. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to teach solution methods for various problems to students, to solve problems by using computer programming, besides theoretical solutions of problems which occur in applied science branches, to be able to find their solutions numerical methods practically. To analyse and to form an estimate of experimental measurement results. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Design and conduct experiments as well as to analyze and interpret data, 2. Make teamwork, Identify, formulate and solve mathematical problems,  3. Gain a knowledge of contemporary issues,  4. Understand the iterative methods,  5. Obtain solution of problems by using numerical methods,  6. Model by using mathematical and basic engineering background. | | | | | | | |
| **TEXTBOOK** | | | | | Yakowitz, S & Szidarovszky, F. (1986). An Introduction to Numerical Computations. Macmillan Publishing company, New York. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Yakowitz, S & Szidarovszky, F. (1986). An Introduction to Numerical Computations. Macmillan Publishing company, New York. 2- Süli, A. & Mayers, D. (2003). An Introduction to Numerical Analysis, Cambridge University Press. 3- Burden, R. L. & Faires J. D. (1993). Numerical Analysis. Fifth ed., PWS Publishing company, Boston. 4- Phillips, G. M. M. & Taylor P. J. (1996). Theory and Applications of Numerical Analysis | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Linear spaces |
| 2 | Linear operators on norm spaces |
| 3 | Approximation theory |
| 4 | Nonlinear equations and their solution by iteration |
| 5 | Solution of systems of linear equations |
| 6 | Midterm Examination 1 |
| 7 | Special matrices |
| 8 | Eigenvalues and eigenvectors of a symmetric matrix |
| 9 | Polynomial interpolation |
| 10 | Numerical integration |
| 11 | Midterm Examination 2 |
| 12 | Initial value problems for ODEs |
| 13 | Boundary value problems for ODEs |
| 14 | Finite difference methods |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Bülent SAKA | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602532 | **TITLE** | Advanced Numerical Analysis II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | B-spline functions, Quadratic, Cubic, Quartic, Quintic, Sextic and Septic B-spline functions, Finite differences, Forward differences, Central differences, Backward differences, Finite element methods, Collocation, Galerkin and least squares methods, Wave equations and numerical solutions, Rlw, Ew, Burgers’, Schrödinger and KdV equations, Stability and convergence, Stability and convergence for linear problems, Stability and convergence for nonlinear problems. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to teach solution methods for various problems to students, to solve problems by using computer programming, besides theoretical solutions of problems which occur in applied science branches, to be able to find their solutions numerical methods practically. To analyse and to form an estimate of experimental measurement results. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Design and conduct experiments as well as to analyze and interpret data, 2. Make teamwork,  3. Identify, formulate and solve mathematical problems,  4. Gain a knowledge of contemporary issues,  5. Understand the iterative methods,  6. Obtain solution of problems by using numerical methods,  7. Model by using mathematical and basic engineering background. | | | | | | | |
| **TEXTBOOK** | | | | | Prenter, P. M. (1975). Splines and variational methods, J. Wiley, New York. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Prenter, P. M. (1975). Splines and variational methods, J. Wiley, New York. 2- Yakowitz, S & Szidarovszky, F. (1986). An Introduction to Numerical Computations. Macmillan Publishing Company, New York. 3- Süli, A. & Mayers, D. (2003). An Introduction to Numerical Analysis, Cambridge University Press. 4- Burden, R. L. & Faires J. D. (1993). Numerical Analysis. Fifth ed., PWS Publishing company, Boston. 5- Phillips, G. M. M. & Taylor P. J. (1996). Theory and Applications of Numerical Analysis. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | B-spline functions, |
| 2 | Quadratic, Cubic, Quartic, Quintic, Sextic and Septic B-spline functions |
| 3 | Finite differences |
| 4 | Forward differences, Central differences and Backward differences |
| 5 | Finite element methods |
| 6 | Midterm Examination 1 |
| 7 | Collocation |
| 8 | Galerkin and least squares methods |
| 9 | Wave equations and numerical solutions |
| 10 | Rlw, Ew, Burgers’,Schrödinger and KdV equations |
| 11 | Midterm Examination 2 |
| 12 | Stability and convergence |
| 13 | Stability and convergence for linear problems |
| 14 | Stability and convergence for nonlinear problems |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Bülent SAKA | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501701503 | **TITLE** | Advanced Game Theory |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition of games, finite two-person zero-sum games, mixed strategies, the optimal strategy and solution of the game, Brown-Robinson method. Non-finite two-person zero-sum games, the return bimatris, balance strategies, a set of return and Pareto optimal strategies, cooperative games, Nash agreement procedure. The two-person games in normal form, Ky Fan inequality. Progressive games, stochastic games, repeated games, differential games. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to gain advanced knowledge about game theory and its techniques and to have practical experience. Further to teach analysis on game theory and application to practical situations is aimed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Function on multi-disciplinary teams,  2. Identify, formulate and solve mathematical problems,  3. Full attendance throughout the semester facilities,  4. Fulfillment of assignet tasks and term papers, use of library and computer-based facilities. | | | | | | | |
| **TEXTBOOK** | | | | | Emrah Akyar, Khalik G. Guseinov, Serkan A. Düzce, Oyun Teorisi, Seçkin Yayınevi, 2010. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Mehmet Ahlatçıoğlu, Fatma Tiryaki, Oyunlar Teorisi, YTÜ Yayın No: YTÜ.FE.DK-98.0343, İstanbul-1998. 2. Ensar Yılmaz, Oyun Teorisi, Literatür yayıncılık, 2012. 3. Michael Maschler, Eilon Solan, Shmuel Zamir, Game Theory, Cambridge University Press, 2013. 4. Steven Tadelis, Game Theory: An Introduction, Princeton University. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Zero Sum Games With Two Person |
| 2 | Zero Sum Games With Two Person |
| 3 | Zero Sum Games With Two Person |
| 4 | Zero Sum Games With Two Person |
| 5 | Zero Sum Games With Two Person |
| 6 | Midterm Examination 1 |
| 7 | Non-Zero Sum Games With Two Person |
| 8 | Non-Zero Sum Games With Two Person |
| 9 | Non-Zero Sum Games With Two Person |
| 10 | Non-Zero Sum Games With Two Person |
| 11 | Midterm Examination 2 |
| 12 | Non-Zero Sum Games With Two Person |
| 13 | Normal Types Games With Two Person |
| 14 | Normal Types Games With Two Person |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ahmet BEKİR | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601501 | **TITLE** | Advaced Projective Geometry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | |  |
| **PREREQUISITE(S)** | | | | | none | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | To obtain information about projective geometry | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Isomorphism and otomorphism, Transformation of dimensional 1 in the projective planes Perspectivities and projectivities, Central collineations, Relationship between central collineations and special theorems of Desargues, Collineations of division ring and field planes, Relationship between projectivities and collineations Perspective collineation, Correlations | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of the course students should be able to:  To understand works about this geometry. Classify projective planes. | | | | | | | |
| **TEXTBOOK** | | | | | 1- Projective Geometry, Rüstem Kaya | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Finite Geometries , P. Dembowski | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Isomorphism and otomorphism |
| 2 | Transformation of dimensional 1 in the projective planes Perspectivities and projectivities |
| 3 | Central collineations |
| 4 | Relationship between central collineations and special theorems of Desargues |
| 5 | Relationship between central collineations and special theorems of Desargues |
| 6 | Midterm Examination 1 |
| 7 | Collineations of division ring and field planes |
| 8 | Collineations of division ring and field planes |
| 9 | Relationship between projectivities and collineations Perspective collineation |
| 10 | Relationship between projectivities and collineations Perspective collineation |
| 11 | Midterm Examination 2 |
| 12 | Proof of Bruck-Ryser theorem. |
| 13 | Correlations |
| 14 | Correlations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. MÜNEVVER ÖZCAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602502 | **TITLE** | Advanced Projective Geometry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Main of the course is to examine projective planes as algebraical properties. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Content of the course is as follows: Coordinate of projective planes and ternary rings, algebrical properties of ternary rings and Location theorems, Obtain projective plane from algebric structure, Classification of projective planes, proof of Bruck-Ryser theorem, Skornyakov-San Saucie Theorem, Artin-Zorn Thorem and their geometrical consequence. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advance knowledge about a subdomain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand coordinate of projective planes and ternary rings,  2. Understand algebrical properties of ternary rings,  3. Obtain projective plane from algebric structure,  4. Classify projective planes. | | | | | | | |
| **TEXTBOOK** | | | | | Projective Geometry, Rüstem Kaya, Finite Geometries , P. Dembowski. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Coordinate of projective planes and ternary rings |
| 2 | Coordinate of projective planes and ternary rings |
| 3 | Algebrical properties of ternary rings and Location theorems |
| 4 | Algebrical properties of ternary rings and Location theorems |
| 5 | Obtain projective plane from algebric structure |
| 6 | Midterm Examination 1 |
| 7 | Obtain projective plane from algebric structure |
| 8 | Obtain projective plane from algebric structure |
| 9 | Classification of projective planes |
| 10 | Classification of projective planes |
| 11 | Midterm Examination 2 |
| 12 | Proof of Bruck-Ryser theorem |
| 13 | Skornyakov-San Saucie Theorem |
| 14 | Artin-Zorn Thorem and their geometrical consequence |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ziya Akça | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601508 | **TITLE** | Advanced Topology I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 40 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Concept covered include open and closed sets, metric spaces, interior and exterior points, countinity, homeomorphisms and seperation axioms. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | This course is an introduction to set-theoretic topology. The aim of this course is to familiarise the student with the basic concept of metric spaces and point-set topology. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Students are expected to learn how to write, in logical manner, proofs using important theorems and properties of metric spaces and topological spaces,  2. Studends learn to solve problems using the concept of topology,  3. Students will be able to divise, organise and present brief solutions based on definitions and theorems of topology,  4. Students who successfully complete this course should be capable of understanding the concept of open and closed sets, the interior, closure and boundary of sets, continuous functions, topological equivalence and sepetation axioms. | | | | | | | |
| **TEXTBOOK** | | | | | Koçak, M., Genel topolojiye Giriş I, Birlik ofset yayıncılık 2004. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Edmonton, A., General Topology, Addison Wesley Publishing Company 1970. 2. Bryant, V., Metric Spaces, Cambridge University Press 1985.  3. Lipschutz, L., General Topology, Schaum's outline Series 1965. 4. Sutherland, W.A., Introduction to Metric and Topological Spaces, Oxford. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Open sets |
| 2 | Open sets |
| 3 | Closed sets |
| 4 | Closed sets |
| 5 | Metric spaces |
| 6 | Midterm Examination 1 |
| 7 | Metric spaces |
| 8 | İnterior and exterior points |
| 9 | İnterior and exterior points |
| 10 | İnterior and exterior points |
| 11 | Midterm Examination 2 |
| 12 | Countinity |
| 13 | Homeomorphisms |
| 14 | Seperation axioms |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Mahmut KOÇAK | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602507 | **TITLE** | Advanced Topology II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 50 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Concept covered include sequences and nets, qutient topology, complete metric spaces, compactness of metric and topological spaces, connectedness, path connectedness. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | This course is an introduction to set-theoretic topology. The aim of this course is to familiarise the student with the basic concept of metric spaces and point-set topology. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Students are expected to learn how to write, in logical manner, proofs using important theorems and properties of metric spaces and topological spaces.  2. Studends learn to solve problems using the concept of topology.  3. Students will be able to divise, organise and present brief solutions based on definitions and theorems of topology.  4. Students who successfully complete this course should be capable of understanding the concept of sequences and nets, quotient topology, complete metric spaces, compactness of metric spaces, connectedness, path connectedness. | | | | | | | |
| **TEXTBOOK** | | | | | Koçak, M., Genel topolojiye Giriş I, Birlik ofset yayıncılık 2004. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Edmonton, A., General Topology, Addison Wesley Publishing Company 1970. 2. Bryant, V., Metric Spaces, Cambridge University Press 1985.  3. Lipschutz, L., General Topology, Schaum's outline Series 1965. 4. Sutherland, W.A., Introduction to Metric and Topological Spaces, Oxford. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Sequences and nets |
| 2 | Sequences and nets |
| 3 | Qutient topology |
| 4 | Qutient topology |
| 5 | Qutient topology |
| 6 | Midterm Examination 1 |
| 7 | Complete metric spaces |
| 8 | Complete metric spaces |
| 9 | Compactness of metric and topological spaces |
| 10 | Compactness of metric and topological spaces |
| 11 | Midterm Examination 2 |
| 12 | Connectedness |
| 13 | Connectedness |
| 14 | Path connectedness |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Mahmut KOÇAK | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602516 | **TITLE** | Integral Equations |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Differantial and partial differential equations | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Basic concepts of Fredholm and Voltera integral equations are given. In addition, various solution methods for these equations are given. Discussed the relationship between differential equations and integral equations. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To model the problems and solve them. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Helps to fix problems by reducing integral equations. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Integral equations,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Integral Denklemler, Prof. Yavuz Aksoy. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Volterra integral equations |
| 2 | Volterra integral equations |
| 3 | Volterra integral equations |
| 4 | Volterra integral equations |
| 5 | Volterra integral equations |
| 6 | Midterm Examination 1 |
| 7 | Fredholm integral equations |
| 8 | Fredholm integral equations |
| 9 | Fredholm integral equations |
| 10 | Fredholm integral equations |
| 11 | Midterm Examination 2 |
| 12 | Approach methods |
| 13 | Approach methods |
| 14 | Approach methods |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Dursun Eser | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601539 | **TITLE** | Integral Transformations |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | Differential equations and partial derivatives equations | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | After giving the Laplace transformations the Ordinary Differential Equations, Partial Differential Equations and Integral Equations are solved by using the laplace Transformations. Fourier Integrals, Fourier transformations and their applications are given. Special functions and their applications are given. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Solutions Of Partial Differential Equations And Differential Equations with Laplace Transforms are given. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Teach you to solve any problems encountered with the help of special functions. Many of the equation can be solved with the help of the Laplace transform . | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Integral transformation,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Uygulamalı Matematik, Prof. Dr. İrfan Baki Yaşar. 2. Special Functions For Engineers and Applied Mathematixians, Larrry C. Andrews. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The Laplace transform |
| 2 | Properties of the Laplace transform |
| 3 | Properties of the Laplace transform |
| 4 | Properties of the Laplace transform |
| 5 | Properties of the Laplace transform |
| 6 | Midterm Examination 1 |
| 7 | Properties of the Inverse Laplace transforms |
| 8 | Properties of the Inverse Laplace transforms |
| 9 | Properties of the Inverse Laplace transforms |
| 10 | Properties of the Inverse Laplace transforms |
| 11 | Midterm Examination 2 |
| 12 | Solution of differential equations |
| 13 | Solution of partial differential equations |
| 14 | Solution of integral equations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Dursun Eser | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601536 | **TITLE** | Integrability and Perturbation Methods I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 5,0 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 25 |
| Quiz | | | | | 1 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Fundamental concepts in classical mechanics (evalution eqns., conservation laws, recursion operator, Hamiltonian, Lagrangian…) , perturbation methods, solving equations using multiple-scale methods. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course to explain the problems that appear in mathematical modelling of a lot of physical , chemical and biological formations are not solvable. Our aims are to determine these problems which we can face with, in various fields are solvable or not. Then to solve using perturbation methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To improve mathematical observation and thought,  2. Appreciate the alternative methods for solving ODEs ,  3. To understand the solvability of ODEs,  4. To use the solvability of ODEs. | | | | | | | |
| **TEXTBOOK** | | | | | M.N. Özer, Related Integrable Hamiltonian Systems.(PhD) | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. V.I. Arnold, Mathematical Methods of Classical Mechanics. 2. F.Taşcan, İntegrallenebilirlik ve Pertürbasyon Teori(PhD). | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Evolution equations..Fundamental concepts in classical mechanics (evalution eqns., conservation laws, recursion operator, Hamiltonian, Lagrangian…) , perturbation methods, solving equations using multiple-scale methods. |
| 2 | Evolution equations. |
| 3 | Evolution equations. |
| 4 | Conservation laws. |
| 5 | Conservation laws. |
| 6 | Midterm Examination 1 |
| 7 | Hamiltonian. |
| 8 | Hamiltonian. |
| 9 | Recursion operator. |
| 10 | Recursion operator. |
| 11 | Midterm Examination 2 |
| 12 | Lagrangian. |
| 13 | Asymptotic series expansions. |
| 14 | Multi-scale expansion method. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Doç. Dr. Filiz Taşcan | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601612 | **TITLE** | Integrability and Perturbation Methods II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 5,0 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 25 |
| Quiz | | | | | 1 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Solving PDEs using multiple-scale methods, Normal Forms. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course to explain the problems that appear in mathematical modelling of a lot of physical , chemical and biological formations are not solvable. Our aims are to determine these problems which we can face with, in various fields are solvable or not. Then to solve using perturbation methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To improve mathematical observation and thought,  2. Appreciate the alternative methods for solving PDEs,  3. To understand the solvability of PDEs,  4. To use the solvability of PDEs. | | | | | | | |
| **TEXTBOOK** | | | | | M.N. Özer, Related Integrable Hamiltonian Systems.(PhD). | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. V.I. Arnold, Mathematical Methods of Classical Mechanics. 2. F.Taşcan, İntegrallenebilirlik ve Pertürbasyon Teori(PhD). | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Multiple-scale method. |
| 2 | Multiple-scale method. |
| 3 | Multiple-scale method. |
| 4 | Solving PDEs using multiple-scale method. |
| 5 | Solving PDEs using multiple-scale method. |
| 6 | Midterm Examination 1 |
| 7 | Solving PDEs using multiple-scale method. |
| 8 | Solving PDEs using multiple-scale method. |
| 9 | Solving PDEs using multiple-scale method. |
| 10 | Normal Forms |
| 11 | Midterm Examination 2 |
| 12 | Normal Forms |
| 13 | Normal Forms |
| 14 | Normal Forms |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Doç. Dr. Filiz Taşcan | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Integration methods for differential equations |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In the literature different methods will be considered for finding first integrals of ordinary differential equations. The methods which include Lagrangian formulation and charactersitics of equations will be discussed. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. Recognize the basic operators in differential equations  2. Finding the Noether symmetries and partial Noether symmetries  3. Finding characteristics of equations  4. Finding first integrals. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | At the end of the course students will recognize the basic operators in differential equations and obtain first integrals with Lagrangian ,partial Lagrangian or formal Lagrangian functions | | | | | | | |
| **TEXTBOOK** | | | | | P. J. Olver, Applications of Lie Groups to Differential Equations | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.George Bluman,Stephen Anco, (2008) Symmetry and Integration Methods for Differential Equations 2. Ibragimov, N.H. (1994). Lie Group Analysis of Differential Equations, CRC Press. 3. Bluman, G.W. ve Kumei, S.(1989). Symmetries and Differential Equations, SpringerVerlag | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic knowledge |
| 2 | Basic operators |
| 3 | Direct method |
| 4 | Betwen the relation symmetry and first integral |
| 5 | Noether approach |
| 6 | Midterm Examination 1 |
| 7 | Ibragimov approach |
| 8 | Adjoint equations and it is symmetries |
| 9 | Classification self adjointness |
| 10 | Application of Ibragimov method to some equations |
| 11 | Midterm Examination 2 |
| 12 | Partial Noether Approach |
| 13 | Application of partial Noether method to some equations |
| 14 | Characteristics method and applications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assistant Prof. Sait San | **Date:** | | 13.04.2016 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602506 | **TITLE** | Category Theory II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) |  |
| **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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Constructions on Categories, Monads and Algebras, Simplicial Category. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course: The understanding the notions of the Category theory and methods which can be effectively used by Mathematicians working in variety of other fields of Mathematical research. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply knowledge of basic mathematics, Apply knowledge of basic mathematics,  2. Understanding the construction of categories, Understanding the construction of categories,  3. Know Monads and Algebras, Know Monads and Algebras  4. Know and apply , the Simplicial Category. | | | | | | | |
| **TEXTBOOK** | | | | | Category theory for working Mathematician (S.MacLane) Springer-Verlag 1988. | | | | | | | |
| **OTHER REFERENCES** | | | | | An İntroduction to Category Theory (H.Herrlich & G.E.Strecker) Allyn & Bacon Inc. (1973). | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Constructions on Categories |
| 2 | Constructions on Categories |
| 3 | Constructions on Categories |
| 4 | Constructions on Categories |
| 5 | Constructions on Categories |
| 6 | Midterm Examination 1 |
| 7 | Monads and Algebras |
| 8 | Monads and Algebras |
| 9 | Monads and Algebras |
| 10 | Monads and Algebras |
| 11 | Midterm Examination 2 |
| 12 | Simplicial Category |
| 13 | Simplicial Category |
| 14 | Simplicial Category |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Zekeriya ARVASİ | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601505 | **TITLE** | Category Theory I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Categories, Functors and Natural Transformations, Limits and Adjoints, Monads and Algebras. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course: The understanding the notions of the Category theory and methods which can be effectively used by Mathematicians working in variety of other fields of Mathematical research. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply knowledge of basic mathematics, Apply knowledge of basic mathematics,  2. Understanding the construction of categories, Understanding the construction of categories,  3. Know functors, natural transformation and functor category Know functors, natural transformation and functor category  4. Know and apply universals and limits, Know and apply universals and limits,  5. Know and apply monads and algebras. | | | | | | | |
| **TEXTBOOK** | | | | | Category theory for working Mathematician (S.MacLane) Springer-Verlag 1988. | | | | | | | |
| **OTHER REFERENCES** | | | | | An İntroduction to Category Theory (H.Herrlich & G.E.Strecker) Allyn & Bacon Inc. (1973). | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Categories |
| 2 | Categories |
| 3 | Categories |
| 4 | Functors and Natural Transformations |
| 5 | Functors and Natural Transformations |
| 6 | Midterm Examination 1 |
| 7 | Limits and Adjoints |
| 8 | Limits and Adjoints |
| 9 | Limits and Adjoints |
| 10 | Monads |
| 11 | Midterm Examination 2 |
| 12 | Monads |
| 13 | Algebras |
| 14 | Algebras |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Zekeriya ARVASİ | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601510 | **TITLE** | Analytical Solutions of Partial Differential Equations I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 25 |
| Quiz | | | | | 1 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The main of the course the problems that appear in mathematical modelling of some physical , chemical and biological formations to solve analytical. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course to explain the problems that appear in mathematical modelling of a lot of physical , chemical and biological formations are not solvable. Our aims are to determine these problems which we can face with, in various fields are solvable or not. Then to solve using perturbation methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Learning how to identify and classify first order linear/ nonlinear PDEs,  2. Learning how to solve first order linear/ nonlinear PDEs,  3. Solving first order linear/ nonlinear PDEs,  4. Learning how to solve Cauchy Problems. | | | | | | | |
| **TEXTBOOK** | | | | | 1. İ.E.Anar (2004), Kısmi Diferensiyel Denklemler,PalmeYay. Ankara. 2. K.Koca (2001), Kısmi Türevli Denklemler,Gündüz Eğt.Yay. Ankara. 3. M. Çağlayan, O.Çelebi (2002), Kısmi Diferensiyel Denklemler,Uludağ Ün. Yay.,Bursa. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. M.N.Özer (2004) Kısmi Türevli Diferensiyel Denklemler ve Çözümlü Problemler Ders Notları. 2. F.H. Miller, Partial Diff. Equations. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | An Introduction to Partial Differential Equations(PDEs), |
| 2 | An Introduction to Partial Differential Equations(PDEs), |
| 3 | Classification of PDEs |
| 4 | First order linear and quasi-linear PDEs |
| 5 | Langrange’s method |
| 6 | Midterm Examination 1 |
| 7 | Characteristics curves |
| 8 | Nonlinear first order PDEs |
| 9 | Charpit’s method |
| 10 | solvable systems |
| 11 | Midterm Examination 2 |
| 12 | Reduction to normal forms |
| 13 | Cauchy’s problems |
| 14 | Cauchy’s problems |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Mehmet Naci ÖZER | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602527 | **TITLE** | Analytical Solutions of Partial Differential Eq-II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 25 |
| Quiz | | | | | 1 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The main of the course the problems that appear in mathematical modelling of some physical , chemical and biological formations to solve analytical. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course to explain the problems that appear in mathematical modelling of a lot of physical , chemical and biological formations are not solvable. Our aims are to determine these problems which we can face with, in various fields are solvable or not. Then to solve using perturbation methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Learning how to solve first order nonlinear PDEs with nth independent variables,  2. Learning how to solve higher order linear PDEs with two independent variables,  3. Solving first and higher order PDEs,  4. Solving initial-value problems for first and higher order PDEs. | | | | | | | |
| **TEXTBOOK** | | | | | 1. İ.E.Anar (2004), Kısmi Diferensiyel Denklemler,PalmeYay. Ankara. 2. K.Koca (2001), Kısmi Türevli Denklemler,Gündüz Eğt.Yay. Ankara. 3. M. Çağlayan, O.Çelebi (2002), Kısmi Diferensiyel Denklemler,Uludağ Ün. Yay.,Bursa. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. M.N.Özer (2004) Kısmi Türevli Diferensiyel Denklemler ve Çözümlü Problemler Ders Notları. 2. F.H. Miller, Partial Diff. Equations. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Jacobi’s method for first order nonlinear PDEs with nth independent variables, ,.,. |
| 2 | Higher order linear PDEs with two and nth independent variables, |
| 3 | Higher order linear PDEs with two and nth independent variables, |
| 4 | Constant coefficients linear PDEs with two independent variables |
| 5 | Constant coefficients linear PDEs with two independent variables |
| 6 | Midterm Examination 1 |
| 7 | Factorizable differential operators |
| 8 | Factorizable differential operators |
| 9 | Normal forms |
| 10 | PDEs of hyperbolic, parabolic and elliptic types |
| 11 | Midterm Examination 2 |
| 12 | Nonlinear second order PDEs. |
| 13 | Solutions of initial-value problems for second order PDEs. |
| 14 | Solutions of initial-value problems for second order PDEs. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Mehmet Naci ÖZER | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601545 | **TITLE** | Numerical solutions of partial differential equations I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Numerical methods for partial differential equations. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to gain the numerical technique to solve the partial differential equations. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics snd Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Classify partial differential equations, Classify partial differential equations  2. Learn difference equations which are one of the basic subjects of numerical analysis, Learn difference equations which are one of the basic subjects of numerical analysis.  3. Solve partial differential equations in various fields,  4. Stability and convergence of finite difference methods. Solve partial differential equations in various fields Solve partial differential equations in various fields | | | | | | | |
| **TEXTBOOK** | | | | | M. K. Jain, Numerical solution of differential equation. | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction |
| 2 | Finite difference schemes |
| 3 | Finite difference schemes |
| 4 | Parabolic equations |
| 5 | Parabolic equations |
| 6 | Midterm Examination 1 |
| 7 | Parabolic equations |
| 8 | Hyperbolic equations |
| 9 | Hyperbolic equations |
| 10 | Hyperbolic equations |
| 11 | Midterm Examination 2 |
| 12 | Elliptic equations |
| 13 | Elliptic equations |
| 14 | Elliptic equations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. İdris Dağ | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601503 | **TITLE** | Combinatorial Geometry -I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | | 25 |
| Quiz | | | | |  | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The main of the course is to introduce Projective spaces,- Affine spaces | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Near Linear Spaces, Linear Spaces, Projective Spaces, Affine spaces | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To give combinatorics of some finite geometries,  2. The students will have knowledge about combinatorial properties of some finite geometries,  3. To understand projective spaces,  4. To understand affine spaces. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Kaya, R. Projektif Geometri(2005)(2003), ESOGU Yayını. 2.Batten, L.M.(1997), Combinatorics of finite Geomerties, Cambridge Univ. Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Near Linear Spaces |
| 2 | Near Linear Spaces |
| 3 | Near Linear Spaces |
| 4 | Linear Spaces |
| 5 | Linear Spaces |
| 6 | Midterm Examination 1 |
| 7 | Linear Spaces |
| 8 | Projective Spaces |
| 9 | Projective Spaces |
| 10 | Projective Spaces |
| 11 | Midterm Examination 2 |
| 12 | Affine spaces |
| 13 | Affine spaces |
| 14 | Affine spaces |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Şükrü OLGUN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602504 | **TITLE** | Combinatorial Geometry -II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | | 25 |
| Quiz | | | | |  | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The main of the course is to introduce Generalized quadrangles, Partial geometries. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Content of the course is as follows : Generalized quadrangles, Partial geometries. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To give combinatorics of some finite geometries,  2. The students will have knowledge about combinatorial properties of some finite geometries,  3.To improve mathematical observation and  thought,  4. To understand the polar spaces. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Kaya, R. Projektif Geometri(2005)(2003), ESOGU Yayını. 2.Batten, L.M.(1997), Combinatorics of finite Geomerties, Cambridge Univ. Press. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Polar Spaces |
| 2 | Polar Spaces |
| 3 | Polar Spaces |
| 4 | Polar Spaces |
| 5 | Polar Spaces |
| 6 | Midterm Examination 1 |
| 7 | Generalized quadrangles |
| 8 | Generalized quadrangles |
| 9 | Generalized quadrangles |
| 10 | Generalized quadrangles |
| 11 | Midterm Examination 2 |
| 12 | Partial geometries |
| 13 | Partial geometries |
| 14 | Partial geometries |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Şükrü OLGUN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501711621 | **TITLE** | Force and Motion I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 25 |
| Quiz | | | | | 1 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Searching for the solution of the mathematical methods encountered in physics and physical interpretations of dynamic problems.Expressing the movement of particle and particle systems by different methods (Hamilton, Lagrange, Hamilton Jakobi ) and searching for the solutions. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course to explain the problems that appear in mathematical modelling of a lot of physical , chemical and biological formations are not solvable. Our aims are to determine these problems which we can face with, in various fields are solvable or not. Then to solve using perturbation methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Get an understanding of professional and ethical responsibility,  2. Identify, formulate, and solve mathematical physics problems,  3. Be conversant with mathematics in the other science (engineering, physics),  4. Design and conduct experiments as well as to analyze and interpret data. | | | | | | | |
| **TEXTBOOK** | | | | | 1. M.N. Özer, Related Integrable Hamiltonian Systems.(PhD),  2. A.P. Fordy, Soliton Theory:a survey of result, 3. M. Spiegel, Theoretical Mechanics. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. D. A. Wells, Langrangian Dynamics. 2. F.Taşcan, İntegrallenebilirlik ve Pertürbasyon Teori(PhD).  3. A. Y. Özemre, Klasik Teorik Mekanik. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Evaluation equations |
| 2 | Evaluation equations |
| 3 | Conservation laws |
| 4 | Conservation laws |
| 5 | Conservation laws |
| 6 | Midterm Examination 1 |
| 7 | Recursion operator |
| 8 | Hamiltonian |
| 9 | Lagrangian |
| 10 | Hamilton Jakobi equation |
| 11 | Midterm Examination 2 |
| 12 | Hamilton Jakobi equation |
| 13 | Poisson Bracket |
| 14 | Liouville's Theorem |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER PhD PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. |  |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. |  |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. |  |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. |  |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. |  |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. |  |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. |  |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. |  |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. |  |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. |  |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. |  |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. |  |  |  |

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| **Prepared by :** | Prof. Dr. Mehmet Naci ÖZER | **Date:** |  |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501702504 | **TITLE** | Lie Algebras |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 40 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Lie Algebras, detailed specifications, Associative Algebras. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Presenting main concepts and techniques in the content of the lesson, improving students’ Lie Algebras knowledge by practising these concepts and techniques. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Lie algebras,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Lie Algebras: Theory and Algorithms (W.A.De Graaf). | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Preliminaries |
| 2 | Preliminaries |
| 3 | Cartan Subalgebras |
| 4 | Cartan Subalgebras |
| 5 | Lie Algebras with Non-Degenerate Killing Form |
| 6 | Midterm Examination 1 |
| 7 | Lie Algebras with Non-Degenerate Killing Form |
| 8 | Classification of Basic Lie Algebras |
| 9 | Classification of Basic Lie Algebras |
| 10 | Representations of Lie Algebras |
| 11 | Midterm Examination 2 |
| 12 | Representations of Lie Algebras |
| 13 | Associative Algebras |
| 14 | Associative Algebras |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Enver Önder USLU | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602612 | **TITLE** | Lorentzian Geometry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | 1- Some information about curves and surfaces in Lorentzian Geometry.  2- Darboux and frenet vector,  3- Curvature line, geodesic line, asimptotic line of spacelike and timelike curve,  4- Some theorems for curves,  5- Denition and theorem with spherical representation of spacelike and timelike curves. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Some information about curves and surfaces in Lorentzian Geometry, Darboux and frenet vector, curvature line, geodesic line, asimptotic line of spacelike and timelike curveSome theorems for curves, Definition and theorem with spherical representation of spacelike and timelike curves. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Apply knowledge of basic mathematics,  2. Conduct applications as well as to analyze and interpret data,  3. Function on multi-disciplinary teams,  4. Identify, formulate, and solve mathematical problems,  5. Computer, software as contemporary methods, techniques apply to mathematics,  6. Communicate effectively,  7. Understand the broad education necessary to understand the impact of mathematical solutions in a global and societal context,  8. Get a recognition of the need for, and an ability to engage in life-long learning,  9. Gain a knowledge of contemporary issues,  10. Develop a research skills for their dissertation. | | | | | | | |
| **TEXTBOOK** | | | | | 1. B. O'Neill, Semi-Riemannian Geometry with Applications to Relativity, Academic Press Inc., London (1983).  2- H. H. Uğurlu, A. Çalışkan, Darboux Ani Dönme vektörleri ile Spacelike ve Timelike Yüzeyler Geometrisi, Ders Notu.  3-Hacısalihoğlu, H. H., Diferensiyel Geometri, Cilt I-II, Ankara Üniversitesi, Fen Fakültesi Yayınları, 1993.  4-Ergin, A. A., Lorentz Düzleminde Kinematik Geometri, Doktora Tezi, Ankara, 1989. 5-Turgut A., 3-Boyutlu Minkowski uzayında Timleke ve Spacelike Regle Yüzeyler, Doktora Tezi, Ankara, 1995. | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Some information about curves and surfaces in Lorentzian Geometry. |
| 2 | Some information about curves and surfaces in Lorentzian Geometry. |
| 3 | Some information about curves and surfaces in Lorentzian Geometry. |
| 4 | Darboux and frenet vector, |
| 5 | Darboux and frenet vector, |
| 6 | Midterm Examination 1 |
| 7 | Darboux and frenet vector, |
| 8 | curvature line, geodesic line, asimptotic line of spacelike and timelike curveSome theorems for curves |
| 9 | curvature line, geodesic line, asimptotic line of spacelike and timelike curveSome theorems for curves |
| 10 | curvature line, geodesic line, asimptotic line of spacelike and timelike curveSome theorems for curves |
| 11 | Midterm Examination 2 |
| 12 | Definition and theorem with spherical representation of spacelike and timelike curves. |
| 13 | Definition and theorem with spherical representation of spacelike and timelike curves. |
| 14 | Definition and theorem with spherical representation of spacelike and timelike curves. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Cumali Ekici | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601541 | **TITLE** | Mathematical 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  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The main of the course is to give an introduction to mathematical modelling subjects which are form the connecting tissue between the real life problems which we want to solve and quantitative analysis which we undertake to do so. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Content of the course is as follows: Introduction to mathematical modeling, non-dimensionalisation and approximation, graphical methods, stability and oscillations, hysteresis and resonance, waves and shocks, non linear diffusion, reaction-diffusion equations. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understand the relation between real life problems and quantitative analysis,  2. Form a judgment on modelling concept,  3. Set up the model for problem,  4. Solving the model which was constructed. | | | | | | | |
| **TEXTBOOK** | | | | | A.C.Fowler (2003), An introduction mathematical modelling, (Lecture Notes, version 2). | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to mathematical modeling, |
| 2 | Introduction to mathematical modeling, |
| 3 | non-dimensionalisation and approximation, |
| 4 | non-dimensionalisation and approximation, |
| 5 | graphical methods, |
| 6 | Midterm Examination 1 |
| 7 | graphical methods, |
| 8 | stability and oscillations, |
| 9 | stability and oscillations, |
| 10 | hysteresis and resonance, |
| 11 | Midterm Examination 2 |
| 12 | waves and shocks, |
| 13 | non linear diffusion, reaction-diffusion equations |
| 14 | non linear diffusion, reaction-diffusion equations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. İdris Dağ | **Date:** | | 13.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602540 | **TITLE** | Numerical Methods With Matlab |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | | 1 | | 25 |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Matlab applications for approximation methods | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main purpose of the course is to learn the numerical technique and to write Matlab code. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about Mathematics and applied science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To learn approximation method for applied science problems,  2. To write suitable program for numerical methods with Matlab,  3. Examining Matlab packages,  4. Applicating approximation method with Matlab. | | | | | | | |
| **TEXTBOOK** | | | | | Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, Mc Graw Hill. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Notes on internet. 2. Jaan Kiusalaas, Numerical methods in Engineering with Matlab, Cambridge University Press. 3. George R. Linfield, J.E.T. Penny, Numerical Methods Using Matlab, Elsevier. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Matlab |
| 2 | Root finding for f(x)=0 |
| 3 | Root finding for f(x)=0 |
| 4 | Linear algebraic equations and matrices |
| 5 | Linear algebraic equations and matrices |
| 6 | Midterm Examination 1 |
| 7 | Curve fitting |
| 8 | Polynomial and spline approximations |
| 9 | Polynomial and spline approximations |
| 10 | Numerical differentiation and integration |
| 11 | Midterm Examination 2 |
| 12 | Initial value problems |
| 13 | Initial value problems |
| 14 | Boundary value problems |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Dursun IRK | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602609 | **TITLE** | Miniquaternion Geometry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | 1. Galois plane of order 3,  2. Conics in projective planes of order 9,  3. Subplanes of projective plane of order 9. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main of the course is to obtain information about Galois plane of order 3 and conics in projective planes of order 9. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advance knowledge about a subdomain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Learn the Galois plane of order 3,  2. To obtain conics in projective planes of order 9,  3. The subplanes of projective plane,  4.Find the subplanes of projective plane of order 9. | | | | | | | |
| **TEXTBOOK** | | | | | T. G. Room and P. B. Kirkpatrick., Miniquaternion geometry. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Galois plane of order 3 |
| 2 | Galois plane of order 3 |
| 3 | Galois plane of order 3 |
| 4 | Galois plane of order 3 |
| 5 | Conics in projective planes of order 9 |
| 6 | Midterm Examination 1 |
| 7 | Conics in projective planes of order 9 |
| 8 | Conics in projective planes of order 9 |
| 9 | Conics in projective planes of order 9 |
| 10 | Subplanes of projective plane of order 9 |
| 11 | Midterm Examination 2 |
| 12 | Subplanes of projective plane of order 9 |
| 13 | Subplanes of projective plane of order 9 |
| 14 | Solving problems. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr.Ziya AKÇA | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601504 | **TITLE** | Projective Geometry of n-Dimensions -I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | | 25 |
| Quiz | | | | |  | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The main of the course is to introduce Projective spaces of n-dimensions, General projective coordinates, Hyperplane coordinates, The cross ratio, projectivities. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Content of the course is as follows : Projective spaces of n-dimensions, General projective coordinates, Hyperplane coordinates, The cross ratio, projectivities. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Teaching of general structures of infinite projective spaces,  2. They will be looked to the geometry in more general and abstractly, since projective geometry is the most general geometry after than topology,  3.To improve mathematical observation and  thought,  4.  To get knowledge about Hyperplane coordinates and projectivities . | | | | | | | |
| **TEXTBOOK** | | | | | 1. Kaya, R. Projektif Geometri(2005)(2003), ESOGU Yayını. 2. Projective Geometry of n Dimension, Otto Schreier, Emanuel Sperner. | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Projective spaces of n-dimensions |
| 2 | Projective spaces of n-dimensions |
| 3 | Projective spaces of n-dimensions |
| 4 | General projective coordinates |
| 5 | General projective coordinates |
| 6 | Midterm Examination 1 |
| 7 | General projective coordinates |
| 8 | Hyperplane coordinates |
| 9 | Hyperplane coordinates |
| 10 | Hyperplane coordinates |
| 11 | Midterm Examination 2 |
| 12 | The cross ratio |
| 13 | projectivities |
| 14 | projectivities |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Şükrü OLGUN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602505 | **TITLE** | Projective Geometry of n-Dimensions -II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | | 25 |
| Quiz | | | | |  | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The main of the course is to introduce Linear projectivities of Pn onto itself, Correlations, Projective classification of hypersurface of the second order, Projective properties of hypersurfaces of the second order. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Content of the course is as follows :Linear projectivities of Pn onto itself, Correlations, Projective classification of hypersurface of the second order, Projective properties of hypersurfaces of the second order. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To give transformations of n-dimensional projective spaces and to examine hypersurfaces of second order in these spaces,  2. The students will have the formation of looking as more abstract and general to concepts of transformation and hypersurface of second order in geometry ,  3.To improve mathematical observation and  thought,  4.To get knowledge about correlations . | | | | | | | |
| **TEXTBOOK** | | | | | 1. Kaya, R. Projektif Geometri(2005)(2003), ESOGU Yayını. 2. Projective Geometry of n Dimension, Otto Schreier, Emanuel Sperner. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Linear projectivities of Pn onto itself |
| 2 | Linear projectivities of Pn onto itself |
| 3 | Linear projectivities of Pn onto itself |
| 4 | Correlations |
| 5 | Correlations |
| 6 | Midterm Examination 1 |
| 7 | Correlations |
| 8 | Projective classification of hypersurface of the second order |
| 9 | Projective classification of hypersurface of the second order |
| 10 | Projective classification of hypersurface of the second order |
| 11 | Midterm Examination 2 |
| 12 | Projective classification of hypersurface of the second order |
| 13 | Projective properties of hypersurfaces of the second order |
| 14 | Projective properties of hypersurfaces of the second order |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Şükrü OLGUN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602535 | **TITLE** | Representation Theory I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Representations, Reducible and İrreducible representations, properties of reducible and irreducible representations in GAP, Repsn Package, AtlasRep Package. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The understanding and application the notions of representations and writing a GAP share package. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledged about a sub-domain of Mathematics and Computer Science. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Understanding the representations with general idea,  2. Searching the reducible and irreducible representations,  3. Learning the tensor product notions of representations,  4. Giving applications for the related topics,  5. Obtaining GAP informations about the representations. | | | | | | | |
| **TEXTBOOK** | | | | | W. Feit, The representation theory of finite groups. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic concepts |
| 2 | Equivalences of representations |
| 3 | Reducible and İrreducible of representations. |
| 4 | Cyclic representations |
| 5 | Tensor product of representations |
| 6 | Midterm Examination 1 |
| 7 | İrreducible representations and GAP |
| 8 | Properties of irreducible representations in GAP |
| 9 | Reducible representations and GAP |
| 10 | Properties of reducible representations in GAP |
| 11 | Midterm Examination 2 |
| 12 | Consists of representations of finite groups |
| 13 | Repsn Package |
| 14 | AtlasRep Package |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. Ahmet Faruk ASLAN | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601618 | **TITLE** | Semi-Riemann Geometry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkısh |
| **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 | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 40 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The aim of the course is to giving base concept of Semi-Riemann theory. To have skill of the problem analysis and solution. To gain analytical thinking, discussion and evaluation. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Manifold Theory, Tensors, Semi-Riemannian Submanifolds, Riemannian ve Lorentz Geometry. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Semi-Riemann theory,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Brickell, F. and Clarck, S., Differentiable Manifolds, van Nostrand Reinhold Company. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Hacısalihoğlu, H. H.(1993), Diferensiyel Geometri, Cilt I, A. Ü. Fen Fakültesi Yayınları. 2. Hacısalihoğlu, H. H.(1994), Diferensiyel Geometri, Cilt II, A. Ü. Fen Fakültesi Yayınları. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Manifold Theory |
| 2 | Manifold Theory |
| 3 | Tensors |
| 4 | Tensors |
| 5 | Semi-Riemannian Manifolds |
| 6 | Midterm Examination 1 |
| 7 | Semi-Riemannian Manifolds |
| 8 | Semi-Riemannian Submanifolds |
| 9 | Semi-Riemannian Submanifolds |
| 10 | Riemannian ve Lorentz Geometry |
| 11 | Midterm Examination 2 |
| 12 | Riemannian ve Lorentz Geometry |
| 13 | Special Relativity |
| 14 | Constructions |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ali Görgülü | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602602 | **TITLE** | Simplicial Algebra |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) |  |
| **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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Simplicial Objects in Algebraic Topology | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Presenting main concepts and techniques in the content of the lesson, improving students’ Simplicial Algebras knowledge by practising these concepts and techniques. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Having sufficient knowledge (graduate level) about Simplicial Algebras,  2. Apply knowledge of basic mathematics,  3. Know and apply Simplicial category,  4. Know and apply homotopy. | | | | | | | |
| **TEXTBOOK** | | | | | Simplicial Objects in Algebraic Topology (Peter May). | | | | | | | |
| **OTHER REFERENCES** | | | | | None | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Simplicial Objects |
| 2 | Homotopy |
| 3 | Fibrations and Minimal Complexes |
| 4 | Fibrations and Minimal Complexes |
| 5 | Twisted Cartesian Product |
| 6 | Midterm Examination 1 |
| 7 | Twisted Cartesian Product |
| 8 | Eilenberg-Maclane Complexes |
| 9 | Eilenberg-Maclane Complexes |
| 10 | Postkinov Systems |
| 11 | Midterm Examination 2 |
| 12 | Postkinov Sistemleri |
| 13 | Loop Cebirleri |
| 14 | Tensör Çarpımı |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Zekeriya ARVASİ | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601514 | **TITLE** | Finite Graphs and Applications I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definitions and Examples of Graphs ,subgraphs ,complements, isomorphisms,vertex degrees, Eular trails and circuits, Hamilton graphs ,Edge,arc and vertex partitions . | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To give fundamentals of graphs knowledge,  2. To be able to analyse the problem which are met in the fields of graphs and to gain the ability of problem solving,  3. To gain graphical thinking, discussion and evaluation. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have the fundamentals of graphical knowledge,  2 To have the fundamentals of finite graphical knowledge,  3. To have graphical thinking and evaluation,  4. The skill of evaluation and studying the problems which occur in other disciplines. | | | | | | | |
| **TEXTBOOK** | | | | | 1- Gramaldi, R. P. Discrete and Combinatotial Mathematics. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Chartrand, G. And Lesniak, L.(1996). Graphs and digraphs Chapman & Hall. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definitions and Examples of Graphs |
| 2 | Definitions and Examples of Graphs |
| 3 | Subgraphs |
| 4 | Complements |
| 5 | Complements |
| 6 | Midterm Examination 1 |
| 7 | Isomorphisms |
| 8 | Vertex degrees |
| 9 | Vertex degrees |
| 10 | Eular trails and circuits |
| 11 | Midterm Examination 2 |
| 12 | Hamilton graphs |
| 13 | Hamilton graphs |
| 14 | Edge,arc and vertex partitions |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. İbrahim Günaltılı | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602528 | **TITLE** | Finite Graphs and Applications II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | | 2 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definitions and Examples of Planer Graphs , the complements of Graph, Coloring the edges of a graph , coloring regions and vertices , incidence, circuit, adjacency , path and cut-set matrices, the realizability of the circuit and cut-set matrices. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To be able to analyse the problem which are met in the fields of graphs and to gain the ability of problem solving.  2. To gain graphical thinking, discussion and evaluation. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have the fundamentals of graphical knowledge and culture,  2. To have the fundamentals of bigraphical knowledge and culture,  3. To have graphical thinking and evaluation,  4. The skill of evaluation and studying the problems which occur in other disciplines. | | | | | | | |
| **TEXTBOOK** | | | | | 1- Gramaldi, R. P. Discrete and Combinatotial Mathematics. | | | | | | | |
| **OTHER REFERENCES** | | | | | 2- Chartrand, G. And Lesniak, L.(1996). Graphs and digraphs Chapman & Hall. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definitions and Examples of Planer Graphs |
| 2 | Definitions and Examples of Planer Graphs |
| 3 | The complements of Graph |
| 4 | The complements of Graph |
| 5 | The complements of Graph |
| 6 | Midterm Examination 1 |
| 7 | Coloring the edges of a graph , coloring regions and vertices , incidence, adjacency |
| 8 | Coloring the edges of a graph , coloring regions and vertices , incidence, adjacency |
| 9 | Path matrices |
| 10 | Path matrices |
| 11 | Midterm Examination 2 |
| 12 | Path matrices |
| 13 | The realizability of the circuit and cut-set matrices. |
| 14 | The realizability of the circuit and cut-set matrices. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. İbrahim Günaltılı | **Date:** | | 05.05.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601531 | **TITLE** | Finite Linear Spaces I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 25 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | To study on Near Linear Spaces, Linear Spaces, Projective Spaces, Affine Spaces, Polar Spaces and Partial Geometries. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To give knowledge about the geometries which are outside of well-known Euclidean geometry.  2. To be able to analyse the problem which are met in the theory of the geometries which are outside of well-known Euclidean geometry and to gain the ability of problem solving. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have advanced knowlegde in private areas of geometry. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1- To be able to analyse the problem which are met in the theory of the geometries which are outside of well-known Euclidean geometry ,  2- To gain the ability of problem solving,  3- To relate with other fields of geometry,  4- To solve the problem about the geometries which are outside of well-known Euclidean geometry. | | | | | | | |
| **TEXTBOOK** | | | | | 1- Batten, L.M. and Beutelspacher, A. , The theory of finite linear spaces, Cambridge university press, 1993. 2- Batten, L.M., Combinatorics of finite geometries, Cambridge university press. 1986. | | | | | | | |
| **OTHER REFERENCES** | | | | | Kaya, R., Projektif Geometri, Osmangazi üniversitesi yayınları , yayın no:111, Eskişehir, 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Near Linear Spaces |
| 2 | Near Linear Spaces |
| 3 | Linear Spaces |
| 4 | Linear Spaces |
| 5 | Projective Spaces |
| 6 | Midterm Examination 1 |
| 7 | Projective Spaces |
| 8 | Affine Spaces |
| 9 | Affine Spaces |
| 10 | Polar Spaces |
| 11 | Midterm Examination 2 |
| 12 | Polar Spaces |
| 13 | Partial Geometries |
| 14 | Partial Geometries |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assist. Prof. Temel ERMİŞ | **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** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601543 | **TITLE** | Spacelike hypersurfaces.Global Differantial Geometry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 1 | | 3 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | In this lecture, we will geoemtry of spacelike hypersurfaces. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Bernstein type results in Minkowski space. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Spacelike hypersurfaces ,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | Luis Alias, Global differential geometry of spacelike hypersurfaces in spacetime, 2009, Phd lecture notes. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Spacetime and examples |
| 2 | Lorenz time orientible |
| 3 | Exp map |
| 4 | Timelike jeodeziklerin maksimize özelliği |
| 5 | Ricci and scalar curvatur |
| 6 | Midterm Examination 1 |
| 7 | Timelike converge condition |
| 8 | Spacetimer |
| 9 | Gauss and Weingarten and Codazzi equations |
| 10 | Gauss and Weingarten and Codazzi equations |
| 11 | Midterm Examination 2 |
| 12 | Maximal hypersurfaces |
| 13 | Maximal hypersurfaces |
| 14 | Genel relativity and spacelike hipersurfaces |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
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| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Nevin Gürbüz | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Symmetry groups and conservation laws of differential equations |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Variational derivatives, Null Lagrangian and divergence condition, variational symmetries, Euler-Lagrange equations, Noether Theorem, Nonlocal conservation method, formal Lagrangian, self Adjointness, classification of self adjointness | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To introduce Lie theory of differential equations,  2. Finding variational symmetries  3. Applying the Noether theorem  4. Finding local non trivial conservation laws . | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Calculating the invariant group transformations using the Lie group transformations,  Finding the variational symmetries  Noether's theorem on applying other equations  Determining non-trivial conservation laws | | | | | | | |
| **TEXTBOOK** | | | | | P. J. Olver, Applications of Lie Groups to Differential EquationsIbragimov, Nail H. CRC Handbook of Lie group analysis of differential equations. Vol. 3. CRC press, 1995. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.Ibragimov, N.H. (1999). Elementary Lie Group Analysis and Ordinary Differential Equations, John Willey & Sons Ltd. 2. Ibragimov, N.H. (1994). Lie Group Analysis of Differential Equations, CRC Press. 3. Ibragimov, Nail H. "A new conservation theorem." Journal of Mathematical Analysis and Applications 333.1 (2007): 311-328. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Variational Derivatives |
| 2 | Null Lagrangians and Divergence |
| 3 | Variational Symmetries |
| 4 | Symmetries of Euler-Lagrange equations |
| 5 | Trivial conservation Laws |
| 6 | Midterm Examination 1 |
| 7 | Noether Theorem |
| 8 | Application of Noether Theorem |
| 9 | Nonlocal conservation theorem |
| 10 | Application of Nonlocal conservation theorem |
| 11 | Midterm Examination 2 |
| 12 | Self adjointness |
| 13 | Classification of self adjointness |
| 14 | Application of Ibragimov's Method to other equations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assistant Prof. Sait San | **Date:** | | 30.11.2015 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501601528 | **TITLE** | Tensor Geometry I |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkısh |
| **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 | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 40 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Vector Spaces, Parellesism, Riemann Geometry,Conversion between manifolds,Conections and tensors,Curvatures, Total absolute curvature. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to giving base concept of tensor geometry. To have skill of the problem analysis and solution. To gain analytical thinking, discussion and evaluation. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Tensor geometry,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Hacısalihoğlu, H. H.(2003), Tensör Geometri, , A. Ü. Fen Fakültesi Yayınları. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Vector Spaces |
| 2 | Vector Spaces |
| 3 | Parellesism |
| 4 | Parellesism |
| 5 | Riemann Geometry |
| 6 | Midterm Examination 1 |
| 7 | Conversion between manifolds |
| 8 | Conversion between manifolds |
| 9 | Conections and tensors |
| 10 | Conections and tensors |
| 11 | Midterm Examination 2 |
| 12 | Curvatures |
| 13 | Total absolute curvature |
| 14 | Total absolute curvature |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ali Görgülü | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501602533 | **TITLE** | Tensor Geometry II |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkısh |
| **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 | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 40 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Total absolute curvature,total mean curvature, Riemannian manifolds with minimal submanifolds, Conformal volume. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main aim of the course is to giving base concept of Tensor Geometry. To have skill of the problem analysis and solution. To gain analytical thinking, discussion and evaluation. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To gain advanced knowledge about a sub-domain of Mathematics and Computer Sciences. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have base concept of Tensor geometry,  2. To have skill of the problem analysis,  3. All this problems evaluate solution,  4. To have analytical thinking, discussion and evaluation. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Hacısalihoğlu, H. H.(2003), Tensör Geometri, , A. Ü. Fen Fakültesi Yayınları. | | | | | | | |
| **OTHER REFERENCES** | | | | | None. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Total absolute curvature |
| 2 | Total absolute curvature |
| 3 | Total mean curvature |
| 4 | Total mean curvature |
| 5 | Riemannian manifolds with minimal submanifolds |
| 6 | Midterm Examination 1 |
| 7 | Riemannian manifolds with minimal submanifolds |
| 8 | Riemannian manifolds with minimal submanifolds |
| 9 | Riemannian manifolds with minimal submanifolds |
| 10 | Riemannian manifolds with minimal submanifolds |
| 11 | Midterm Examination 2 |
| 12 | Conformal volume |
| 13 | Conformal volume |
| 14 | Conformal volume |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
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| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Ali Görgülü | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

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**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 501011101 | **TITLE** | The Scientific Research Methods and Its Ethics |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| MSc-  Ph.D | 3 | | 0 | 0 | | | 3+0 | 7,5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 1,5 | | 1,5 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Science, the scientific thought and other fundamental concepts, the scientific research process and its techniques, Methodology: Data Collecting-Analysis-Interpretation, Reporting the scientific research (Preparation of a thesis, oral presentation, article, project), Ethics, Ethics of scientific research and publication. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The main objectives are: To examine the foundations of scientific research and the scientific research methods, to teach the principles of both the methodology and the ethics, to realize the process on a scientific research and to evaluate the results of research, to teach reporting the results of research (on a thesis, presentation, article). | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Applying the scientific research methods and the ethical rules in their professional life. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Gaining awareness on ethical principles at basic research methods, becoming skillful at analyzing and reporting the data obtained in scientific researches, being able to have researcher qualification with occupational sense of responsibility, having the scientific and vocational ethics’ understanding and being able to defend this understanding in every medium. | | | | | | | |
| **TEXTBOOK (Turkish)** | | | | | Karasar, N. (2015). Bilimsel Araştırma Yöntemi. Nobel Akademi Yayıncılık, Ankara. | | | | | | | |
| **OTHER REFERENCES** | | | | | **1-**Büyüköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., Karadeniz, Ş., Demirel, F. (2012). Bilimsel Araştırma Yöntemleri. Pegem Akademi Yayınevi, Ankara.  **2-**Tanrıöğen, A. (Editör). (2014). Bilimsel Araştırma Yöntemleri. Anı Yayıncılık, Ankara.  **3-**Türkiye Bilimler Akademisi Bilim Etiği Komitesi. Bilimsel Araştırmada Etik ve Sorunları, Ankara: TÜBA Yayınları, (2002).  **4-**Ekiz, D. (2009). Bilimsel Araştırma Yöntemleri: Yaklaşım, Yöntem ve Teknikler. Anı Yayıncılık, Ankara.  **5-**Day, Robert A. (Çeviri: G. Aşkay Altay). (1996). Bilimsel Makale Nasıl Yazılır ve Nasıl Yayımlanır?, TÜBİTAK Yayınları, Ankara.  **6-**Özdamar, K. (2003). Modern Bilimsel Araştırma Yöntemleri. Kaan Kitabevi, Eskişehir.  **7-**Cebeci, S. (1997). Bilimsel Araştırma ve Yazma Teknikleri. Alfa Basım Yayım Dağıtım, İstanbul.  **8-**Wilson, E. B. (1990). An Introduction to Scientific Research. Dover Pub. Inc., New York.  **9-**Çömlekçi, N. (2001). Bilimsel Araştırma Yöntemi ve İstatistiksel Anlamlılık Sınamaları. Bilim Teknik Kitabevi, Eskişehir. | | | | | | | |

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

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INSTITUTE’S GRADUATE PROGRAMME’S LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (M.Sc.-Ph.D.)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Having the scientific and vocational ethics’ understanding and being able to defend this understanding in every medium. | | |  | |  |  |
| **LO 2** | Being able to have researcher qualification with occupational sense of responsibility. | | |  | |  |  |
| **LO 3** | Becoming skillful at analyzing and reporting the data obtained in scientific researches. | | |  | |  |  |
| **LO 4** | Gaining awareness on ethical principles at basic research methods. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | | 14.06.2016 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501702508 | **TITLE** | Convex Geometry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 25 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | To study on Introduction to N-dimensional Geometry, Topology, Convex Sets, Convexity. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To give knowledge about the Convex geometries.  2. To be able to analyse outside of well-known Euclidean geometry in terms of axiomatic | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have advanced knowlegde in private areas of geometry | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1-To be able to analyse the problem which are met in the theory of the geometries which are outside of well-known Euclidean geometry  2-To gain the ability of problem solving.  3-To relate with other fields of geometry  4-To solve the problem about the geometries which are outside of well-known Euclidean geometry. | | | | | | | |
| **TEXTBOOK** | | | | | 1- J. E. Leonard, J. E. Lewis, Geometry of Convex Sets, Wiley, 2015 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1- Russel Benson, Euclidean Geometry and Convexity, McGRAW-HILL, 1967 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to N-Dimensional Geometry |
| 2 | Distance in N-Space |
| 3 | Convex Sets |
| 4 | Topology |
| 5 | Compact Sets |
| 6 | Midterm Examination 1 |
| 7 | Applications of Compactness |
| 8 | Convexity |
| 9 | Basic Properties of Convex Sets |
| 10 | Convex Hulls |
| 11 | Midterm Examination 2 |
| 12 | Interior and Closure of Convex Sets |
| 13 | Affine Hulls |
| 14 | Seperation Theorems |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Asst. Prof. Temel ERMİŞ | **Date:** | | 23.11.2016 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 501701506 | **TITLE** | Dynamic Systems |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Systems of differential equations and their relation to dynamic systems,  Existence-uniqueness theorems for scalar differential equations,Calculation of eigenvalues and eigenvectors, basic theory of systems of n-dimensional homogenous differential equations,  Autonomous systems and phase plane, Critical point types: node, saddle, center and spiral points. Stability states of critical points, Critical points and stability states of linear systems, Lyapunov direct method, Simple critical points of nonlinear systems, Conservative systems | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To see the applications of differential equations in dynamic systems,  2. To handle the problems of existence and Uniqueness  3. Find the critical points of the phase plane  4. Determine the type of stability of critical points | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have an advanced knowledge in a sub-field of Mathematics and Computer Science | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Investigation of the existence and uniqueness problems of differential equations,  Foundation of critical points of dynamic systems  Classification of stability situations and graphing with matlab  Linearization of nonlinear systems | | | | | | | |
| **TEXTBOOK** | | | | | Morris W. Hirsch, Stephen Smale and Robert L. Devaney (Auth.)-Differential Equations, Dynamical Systems, and an Introduction to Chaos-Academic Press (2012) | | | | | | | |
| **OTHER REFERENCES** | | | | | Lawrence Perko Differential Equations and Dynamical Systems, Third Edition | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Existence and Uniqueness Theorems |
| 2 | Two dimensional linear differential equation systems |
| 3 | Non-homogen linear differential equation systems |
| 4 | Eigen value and Eigen vectors |
| 5 | n-dimensional linear systems |
| 6 | Midterm Examination 1 |
| 7 | nonlinear equation systems and first integrals |
| 8 | two dimensional Hamiltonian systems |
| 9 | Automonus Systems |
| 10 | Determining critical point |
| 11 | Midterm Examination 2 |
| 12 | Critical points and stability for linear equation systems |
| 13 | Stability with Lyapunov Method |
| 14 | Mathematical Models |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assistant Prof. Sait San | **Date:** | | 7.04.2017 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Theory of Generalized Bilinear Derivates |

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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 (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Bilinear derivatives, bilinear equations, generalized bilinear derivates, generalized bilinear equations, linear superposition principle, Bell polynomials, the relation between Bell polynomials and generalized bilinear derivatives, N-wave solutions of generalized bilinear equations. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To be able to comprehend bilinear derivatives and equations concepts and express a given equation in bilinear form  2. To be able to express bilinear equations in generalized bilinear and real forms  3. To be able to apply linear superposition principle to generalized bilinear equations  4. To be able to comprehend the transition between Bell polynomials and bilinear form in the sense of both derivatives | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To be able to have advanced knowledge on a subfield of Mathematics-Computer sciences | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To be able to comprehend theory of generalized bilinear form and equation  2. To be able to analyze the linear superposition principle used for bilinear equations and extend this method so that can be used for generalized bilinear equations  3. To be able to comprehend transition between bilinear form and Backlund transformation  4. To be able to N-wave solutions of generalized bilinear equations by applying linear superposition principle | | | | | | | |
| **TEXTBOOK** | | | | | W.X. Ma and E.G. Fan, Linear superposition principle applying to Hirota bilinear equations, Computers and Mathematics with Applications, 61(2011), 950-959.W. X. Ma, Generalized bilinear differential equations, Studies in Nonlinear Sciences, 2(2011), 140-144. | | | | | | | |
| **OTHER REFERENCES** | | | | | W. X. Ma, Bilinear equations, Bell polynomials and linear superposition principle, Journal of Physics: Conference Series, 411(2013), 012021W. X. Ma, Bilinear equations and resonant solutions characterized by Bell polynomials, Reports on Mathematical Physics, 72(2013), 41-56. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Bilinear derivatives |
| 2 | Bilinear equations |
| 3 | Generalized bilinear derivatives |
| 4 | Generalized bilinear derivatives |
| 5 | Generalized bilinear equations |
| 6 | Midterm Examination 1 |
| 7 | Linear superposition principle |
| 8 | Bell polynomials |
| 9 | Bell polynomials |
| 10 | Transition between Bell polynomials and generalized bilinear form |
| 11 | Midterm Examination 2 |
| 12 | Transition between Bell polynomials and generalized bilinear form |
| 13 | N-wave solutions |
| 14 | N-wave solutions |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Asst. Prof. Ömer Ünsal | **Date:** | | 06.11.2017 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Volterra-Fredholm Integral Equations |

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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 (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Types of integral equations, integro-differential equations, Fredholm integral equations, Volterra integral equations, Volterra-Fredholm integral equations, solution methods for integral equations, solution methods for integro-differential equations. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. Understanding integral equation notion and classifying a given integral equation  2. Understanding integro-differential equation notion and classifying a given integro-differential equation  3. To be able to find solutions of Volterra, Fredholm and Volterra-Fredholm integral equations  4. To be able to find solutions of Volterra and Fedholm integro-differential equations | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To be able to have advanced knowledge on a subfield of Mathematics-Computer sciences | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To be able to comprehend types of integral and integro-differential equations  2. To be able to analyze classification of integral and integro-differential equations and obtain solutions to them with appropriate methods  3. To be able to apply Adomian decomposition method, modified decomposition method, Laplace transform method and series solution method | | | | | | | |
| **TEXTBOOK** | | | | | Abdul-Majid Wazwaz, Linear and Nonlinear Integral Equations-Methods and Applications, Springer, 2011. | | | | | | | |
| **OTHER REFERENCES** | | | | | Ram P. Kanwal, Linear integral equations, Birkhuser, 2012.Abdul J. Jerri, Introduction to integral equations with applications, John Wiley&Sons, 1999. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Classification of integral equations |
| 2 | Volterra integral equations |
| 3 | Volterra integral equations |
| 4 | Adomian decomposition method, modified decomposition method |
| 5 | Laplace transform method, series solution method |
| 6 | Midterm Examination 1 |
| 7 | Fredholm integral equations |
| 8 | Fredholm integral equations |
| 9 | Adomian decomposition method, modified decomposition method |
| 10 | Series solution method |
| 11 | Midterm Examination 2 |
| 12 | Integro-differential equations |
| 13 | Volterra integro-differential equations |
| 14 | Fredholm integro-differential equations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Asst. Prof. Ömer Ünsal | **Date:** | | 26.03.2018 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Deep Lerarning |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Linear Algebra and Deep Learning Basics, Probability and Information Theory, Learning Algorithms, Regularization for Deep Learning, Optimization for Training Deep Models, Convolutional Networks, Practical Methodology, Monte Carlo Methods, Deep Generative Models | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The understanding and application the notions of the deep learning | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Know and apply deep learning algorithms,  Know and apply deep learning aplications | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | |  | | | | | | | |
| **TEXTBOOK** | | | | | Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, Lecture Notes | | | | | | | |
| **OTHER REFERENCES** | | | | | - | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Linear Algebra and Deep Learning Basics |
| 2 | Probability and Information Theory |
| 3 | Learning Algorithms |
| 4 | Regularization for Deep Learning |
| 5 | Optimization for Training Deep Models |
| 6 | Midterm Examination 1 |
| 7 | Convolutional Networks |
| 8 | Practical Methodology |
| 9 | Monte Carlo Methods |
| 10 | Deep Generative Models |
| 11 | Midterm Examination 2 |
| 12 | Applications |
| 13 | Applications |
| 14 | Applications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Internet of Things |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Integration of objects with individual, Tracking individuals through internet compatible objects, It is aimed to be information about personalized technology subjects | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The understanding and application the notions of the internet of things | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Know and apply internet of things aplications | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | |  | | | | | | | |
| **TEXTBOOK** | | | | | Rifkin J. (2015) Nesnelerin İnterneti ve İşbirliği Çağı (Çev: Levent Göktem). İstanbul: Optimist | | | | | | | |
| **OTHER REFERENCES** | | | | | Greengard S.(2017) Nesnelerin İnterneti (Çev: Müge Çavdar). İstanbul: Optimist | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Internet of Things (IoT) : Introduction |
| 2 | Learning M2M concept |
| 3 | Comparing M2M and IoT |
| 4 | Application Areas of IoT |
| 5 | IoT Architecture and Components |
| 6 | Midterm Examination 1 |
| 7 | Introduction of IoT Auxiliary Technologies (IoT Yardımcı Teknolojilerin Tanıtılması (Arduino, Raspberry Pi, ESP8266, NodeMcu) |
| 8 | Introduction of IoT Auxiliary Technologies (IoT Yardımcı Teknolojilerin Tanıtılması (RFID, NFC, BLE Beacon, WSN, GSM) |
| 9 | IoT and Security |
| 10 | IoT Communication Technologies (GSM, GPS and Applications) |
| 11 | Midterm Examination 2 |
| 12 | IoT Communication Protocols |
| 13 | IoT Operating Systems: TinyOS, Google Brillo |
| 14 | IoT Platforms for Big Data and Cloud Computing |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Introduction to Methods of Exact Solutions |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 25 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction and classification of partial differential equations, determination of nonlinear partial differential equations and research of the solution methods of these equations. Introduction and applications of the complete solution methods in the literature | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to give some complete solution methods for nonlinear equations and to reach the solution of nonlinear equations by using these solution methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have a knowledge in the field of mathematics, to transfer this knowledge to the computer. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Ability to do team work,  2. Ability to comprehend, analyze and apply problems in the related branch,  3. Ability to monitor innovations related to the subject,  4. Development and evaluation of mathematical thinking. | | | | | | | |
| **TEXTBOOK** | | | | | A.M. Wazwaz, Partial Differential Equation: Method and Applications, Balkema Publishers, Netherlands, 2002. | | | | | | | |
| **OTHER REFERENCES** | | | | | Sergey V. Meleshko, Methods for Constructing Exact Solutions of Partial Differential Equations, Springer US, 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition and classification of partial differential equations. |
| 2 | Definition and classification of nonlinear partial differential equations. |
| 3 | Statement of the concept of solution |
| 4 | Definition and classification of solutions of partial differential equations. |
| 5 | Examination of existing solution methods in the literature |
| 6 | Analysis of the advantages and constraints of these solution methods. |
| 7 | Existing complete solution methods |
| 8 | Seminar |
| 9 | Tanh method and applications |
| 10 | Tanh method and applications |
| 11 | sin-cos method and applications |
| 12 | sin-cos method and applications |
| 13 | G'/G method and applications |
| 14 | G'/Gx method and applications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Filiz Taşcan | **Date:** | | 05.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 0 | **TITLE** | Methods of Exact Solutions |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 25 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 1 | | 25 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | It will be given as a continuation of the Introduction to exact solution methods course in the fall semester. Determination of partial differential equations and introduction of exact solution methods of these equations and their applications will continue. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of the course is to give some complete solution methods for nonlinear equations and to reach the solution of nonlinear equations by using these solution methods. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have a knowledge in the field of mathematics, to transfer this knowledge to the computer. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Ability to do team work,  2. Ability to comprehend, analyze and apply problems in the related branch,  3. Ability to monitor innovations related to the subject,  4. Development and evaluation of mathematical thinking. | | | | | | | |
| **TEXTBOOK** | | | | | A.M. Wazwaz, Partial Differential Equation: Method and Applications, Balkema Publishers, Netherlands, 2002. | | | | | | | |
| **OTHER REFERENCES** | | | | | Sergey V. Meleshko, Methods for Constructing Exact Solutions of Partial Differential Equations, Springer US, 2005. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | First integral method and its applications |
| 2 | Writing the maple program of the first integral method and its applications |
| 3 | Exponential function method |
| 4 | Applications of exponential function method to nonlinear partial differential equations |
| 5 | Applications of exponential function method to nonlinear difference equations |
| 6 | Functional variable method and its applications |
| 7 | Writing and applications of the functional variable method maple program |
| 8 | Seminar |
| 9 | Writing and applications of the functional variable method maple program |
| 10 | Pertürbation Teori |
| 11 | Multiple-scale expansion method |
| 12 | Multiple-scale expansion method end its application |
| 13 | He's homotopy perturbation method |
| 14 | Application of He's homotopy perturbation method |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Filiz Taşcan | **Date:** | | 09.11.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Introduction to Generalized Metric Spaces |

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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 (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 40 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | n-order G-metric spaces, S-metric spaces, A-metric spaces, b-metric spaces and their variations, orthogonal metric spaces | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1) To introduce generalized metric spaces, which are the last generalizations of the usual metric spaces in the literature,  2) To examine the existence and uniqueness of solutions of functional equations in generalized metric spaces. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | New techniques will be learned by following the latest developments and advances in metric fixed point theory. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1) To have knowledge about generalized metric spaces,  2) To be able to comprehend, analyze and apply the latest techniques and methods in the literature in metric fixed point theory to different problems. | | | | | | | |
| **TEXTBOOK** | | | | | Fixed Point Theory in Metric Type Spaces, Ravi P. Agarwal, Erdal Karapınar, Donal O’Regan Antonio Francisco Roldán-López-e-Hierro | | | | | | | |
| **OTHER REFERENCES** | | | | | 1) Background and Recent Developments of Metric Fixed Point Theory, Dhananjay Gopal, Poom Kumam, Mujahid Abbas  2) Elementary Fixed Point Theorems, P. V. Subrahmanyam  3) Fixed Point Theory in Distance Spaces, William Kirk, Naseer Shahzad  4) Fixed Point Theory in Metric Spaces-Recent Advances and Applications-Praveen Agarwal, Mohamed Jleli, Bessem Samet | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Conventional metric spaces and their topological properties |
| 2 | G-metric spaces with order n |
| 3 | Topological properties in G-metric spaces with order n |
| 4 | Fixed point theorems in G-metric spaces with order n |
| 5 | S and A-metric spaces |
| 6 | Topological properties in S and A-metric spaces |
| 7 | Fixed point theorems in S and A-metric spaces |
| 8 | MIDTERM |
| 9 | b-metric spaces and variations of b-metric spaces |
| 10 | Topological properties in b-metric spaces |
| 11 | Fixed point theorems in b-metric spaces |
| 12 | Orthogonal metric spaces |
| 13 | Topological properties in orthogonal metric spaces |
| 14 | Fixed point theorems in orthogonal metric spaces |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assistant Professor Temel Ermiş | **Date:** | | 10.11.2021 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Introduction to Hyperbolic 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 (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 5 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | NONE | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Axioms of Euclidean Geometry, Euclidean Rigid Motions, Inversions, The Hyperbolic Plane, Euclidean Versus Hyperbolic Geometry, The Hyperbolic Triangle, The hyperbolic area | | | | | | | |
| **COURSE OBJECTIVES** | | | | | It is to understand and make sense of hyperbolic geometry which has non-uniqueness parallels and of course the concepts of hyperbolic geometry. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To learn a geometric structure, which is a class of non-Euclidean geometries. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1 Introduces the concept of hyperbolic geometry and teaches its history.  2 It teaches to relate with geometric structures other than Euclidean geometry.  3 Can compare Euclidean geometry and hyperbolic geometry.  4 Can perform operations using hyperbolic geometry tools in various application areas.  5 Be able to relate to understand and make sense of the structures in the universe. | | | | | | | |
| **TEXTBOOK** | | | | | Saul Stahl, A gateway to modern geometry : the Poincare half-plane, JONES AND BARTLETT PUBLISHERS, Sudbury, Massachusetts | | | | | | | |
| **OTHER REFERENCES** | | | | | Anderson, James W., Hyberbolic geometry, Springer | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Axioms of Euclidean Geometry |
| 2 | Euclidean Rigid Motions |
| 3 | Inversions |
| 4 | The Hyperbolic Plane |
| 5 | The Hyperbolic Plane |
| 6 | Euclidean Versus Hyperbolic Geometr |
| 7 | Euclidean Versus Hyperbolic Geometr |
| 8 | Euclidean Versus Hyperbolic Geometr |
| 9 | The Hyperbolic Triangle |
| 10 | The Hyperbolic Triangle |
| 11 | The Hyperbolic Triangle |
| 12 | The hyperbolic area |
| 13 | The hyperbolic area |
| 14 | The hyperbolic area |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. Özcan Gelişgen | **Date:** | | 10.11.2021 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Introduction to Lorentz Geometry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 |  | | | 3 | 7.5 | COMPULSORY  ( X ) | | ELECTIVE  (   ) | Türkish |
| **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 | | | | | 1 | | 40 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 60 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Basic concepts,Euclidian and Minkowski 2-Space, spacelike, timelike, lightlike vectors, time leading in R^3\_1 space, concept of angle in R^2\_1 space, vector product in R^3\_1 Minkowski 3-space and unit spheres, instantaneous rotation vectors for time-like curves and solid trihedron, instantaneous rotation vectors for time-like prime and curves with binormal. Introduction to 1-parameter plane motios in Lorentz means. Derivative formulas for 1-parameter plane motion,composition of velocities, Pole of rotation,orbits of poles,1-parameter accelerations in Lorentz means,composition of accelerations, Moving coordinate system, Calculating pole of rotation and planes moving wrt. each other. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Introducing Lorentz geometry as a different kind of geometry | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Be able to analyze with knowledge of merik. Be able to grasp and distinguish various geometries. Be able to define and concept Lorentz Space besides Euclidian space. | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | B. O'Neill, Semi-Riemannian Geometry with Applications to Relativity, Academic Press Inc., London (1983). Birman, G. S.; Nomizu, K. “Trigonometry in Lorentzian Geometry”, Ann. Math. Mont. 91(9), (1984), 534-549. rgin, A. A., Lorentz Düzleminde Kinematik Geometri, Doktora Tezi, Ankara Ü., 1989. Turgut A., 3-Boyutlu Minkowski uzayında Timleke ve Spacelike Regle Yüzeyler, Doktora Tezi, Ankara Ü. , 1995. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basic concepts |
| 2 | Euclidian and Minkowski 2-Space |
| 3 | Spacelilke, Timelike, lightlike vectors, time leading in R^3\_1 space Space |
| 4 | concept of angle in R^2\_1 space |
| 5 | vector product in R^3\_1 Minkowski 3-space and unit spheres |
| 6 | instantaneous rotation vectors for time-like curves and solid trihedron. |
| 7 | instantaneous rotation vectors for time-like prime and curves with binormal. |
| 8 | Midterm |
| 9 | Introduction to 1-parameter plane motios in Lorentz means. |
| 10 | Derivative formulas for 1-parameter plane motion,composition of velocities. |
| 11 | Pole of rotation,orbits of poles. |
| 12 | 1-parameter accelerations in Lorentz means. |
| 13 | composition of accelerations. |
| 14 | Moving coordinate system and Calculating pole of rotation and planes moving wrt. each other |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr Cumali EKİCİ | **Date:** | | 05.05.2020 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Introduction To Fixed Point 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 (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 2 | | 10 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | | 2 | | 10 |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Pre-knowledges from Analysis and Topology, Basic fixed point concept, Contractive Maps, Banach contraction principle, Picard iteration and sequence, Picard's theorem, Non-expanding maps, Fixed point theorem for non-expanding maps, Fixed point theorems in metric space and Generalized Metric spaces | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is to give the basic concepts of Fixed Point Theory and the relationships between these concepts. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have advanced knowledge in fixed point theory. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1-To analyze the problems encountered in fixed point theory  2-To produce solutions to these problems  3-To establish the connection of fixed point theory with the subthemes of mathematics.  4-Understanding the concepts in fixed point theory, applying the results are obtained in metric spaces to more general spaces | | | | | | | |
| **TEXTBOOK** | | | | | Fixed Point Theory in Metric Type Spaces, R. P. Agarwal, E. Karapınar,D. O’Regan, A. F. Roldán, López-de-Hierro | | | | | | | |
| **OTHER REFERENCES** | | | | | Fixed Point Theory and Applications, R. P. Agarwal, M.Meehan, D. O’Regan | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Preliminary information from Analysis and Topology |
| 2 | Preliminary information from Analysis and Topology |
| 3 | Preliminary information from Analysis and Topology |
| 4 | Basic Fixed Point Concept |
| 5 | Contractive Maps, Banach contraction principle, |
| 6 | Picard iteration and sequence, Picard's theorem, |
| 7 | Non-expanding maps, Fixed point theorem for non-expanding maps |
| 8 | Fixed point theorems in the metric space |
| 9 | Fixed point theorems in the metric space |
| 10 | Fixed point theorems in the metric space |
| 11 | Fixed point theorems in Generalized Metric spaces |
| 12 | Fixed point theorems in Generalized Metric spaces |
| 13 | Fixed point theorems in Generalized Metric spaces |
| 14 | Fixed point theorems in Generalized Metric spaces |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
| **LO 3** | Using the uncertain, limited or incomplete data with scientific methods completes the knowledge and implements; able to use together information from different disciplines. | | |  | |  |  |
| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assistant Professor Temel ERMİŞ | **Date:** | | 03.04.2019 | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Natural Language Processing |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Morphological analysis of language, differet grammatical structures, phonology, language models, clustering and classification algorithms, natural language processing issues | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The understanding and application the notions of the Natural Language Processing | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Know and apply Natural Language Processing aplications | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | |  | | | | | | | |
| **TEXTBOOK** | | | | | Rifkin J. (2015) Nesnelerin İnterneti ve İşbirliği Çağı (Çev: Levent Göktem). İstanbul: Optimist | | | | | | | |
| **OTHER REFERENCES** | | | | | Greengard S.(2017) Nesnelerin İnterneti (Çev: Müge Çavdar). İstanbul: Optimist | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction to Natural Language Processing |
| 2 | Natural Language Processing Levels and Relationships |
| 3 | Syntactic and Morphological analysis |
| 4 | Semantic |
| 5 | Language Models (I) |
| 6 | Midterm Examination 1 |
| 7 | Language Models (II) |
| 8 | Text Classification |
| 9 | Hidden Markov Models and Applications |
| 10 | Grammars and Decomposition Algorithms (I) |
| 11 | Midterm Examination 2 |
| 12 | Grammars and Decomposition Algorithms (II) |
| 13 | Clearing the Word Meaning Uncertainty |
| 14 | Machine Translation |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
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| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
| **LO 7** | Theoretical, experimental and modeling based design research and practice; examines the complex problems encountered in this process and solutions. | | |  | |  |  |
| **LO 8** | Ability to work effectively in inner or multi-disciplinary teams, is able to lead in the such team and able to develop solution approaches in complex cases; work independently and take responsibility. | | |  | |  |  |
| **LO 9** | Ability to communicate in written and oral forms, use at least one foreign language European Language Portfolio C1 General Level. | | |  | |  |  |
| **LO 10** | The process and results of the studies, at this or outside areas national and international environment be transfer systematically and clearly written or oral. | | |  | |  |  |
| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | |  | | | |

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | PHP and MVC Framework |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7.5 | COMPULSORY  ( x ) | | ELECTIVE  (   ) | 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 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | MVC (Model View Controller) Basics, MVC architecture, model/view/controller layers, laravel and symfony frameworks and applications | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The understanding and application the notions of the PHP (PHP: Hypertext Preprocessor) MVC | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Know and use PHP frameworks,  Know and apply MVC | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | |  | | | | | | | |
| **TEXTBOOK** | | | | | Pitt, Chris (2012). Pro PHP MVC | | | | | | | |
| **OTHER REFERENCES** | | | | | - | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Fundamental of MVC |
| 2 | Model, View and Controller Layers |
| 3 | Framework Concepts |
| 4 | Composer |
| 5 | Database Operations |
| 6 | Midterm Examination 1 |
| 7 | Laravel Framework (I) |
| 8 | Laravel Framework (II) |
| 9 | Symfony Framework (I) |
| 10 | Symfony Framework (II) |
| 11 | Midterm Examination 2 |
| 12 | Applications |
| 13 | Applications |
| 14 | Applications |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
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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** | **MATHEMATICS-COMPUTER (MSc)** | **SEMESTER** |  |

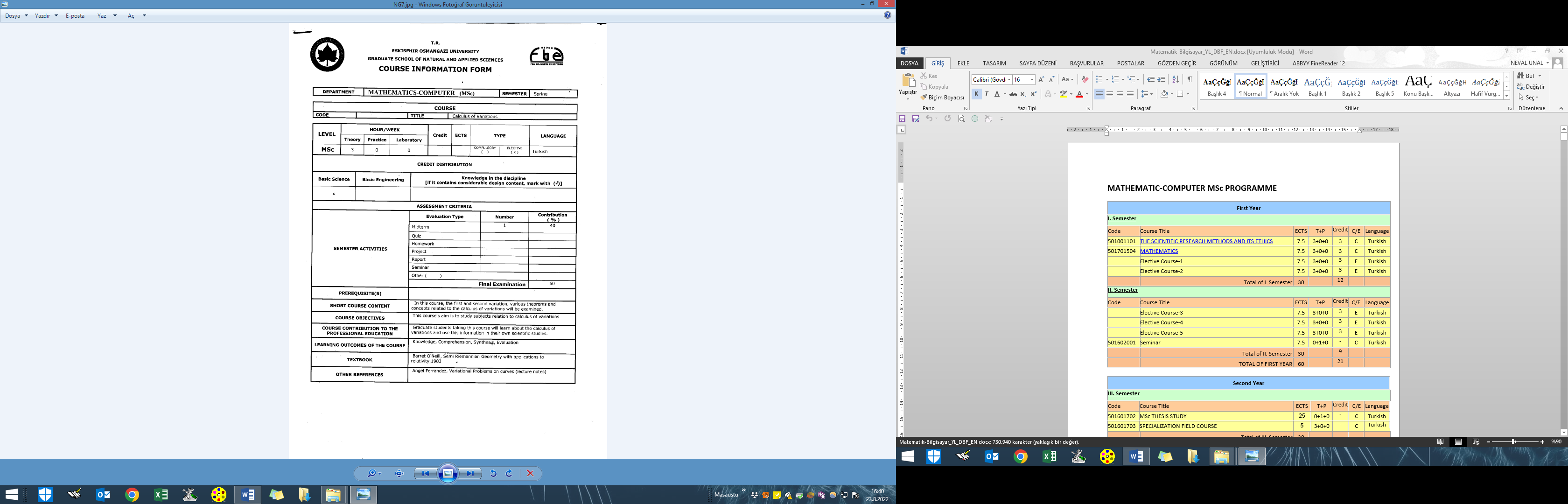
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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Lie Symmetry Analysis of Fractional Order Differential Equations |

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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 (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **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** | | | | | Obtaining symmetry generators of fractional order differential equations and obtaining exact solutions by similarity reductions | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Find symmetries of differential equations manually and by using symbolic packages.  Solve FPDEs and systems of FPDEs using Lie symmetries  Reduce fractional partial differential equations by reduction of the number of independent variables | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To have knowledge about Lie symmetry theory which has many applications. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1-Compute symmetries of FPDEs manually and by using computer packages  2-Find invariants, canonical variables using the symmetries of differential equations  3- Solve FPDEs and systems using classical methods  4-Accessing exact solutions with the help of symmetry | | | | | | | |
| **TEXTBOOK** | | | | | Hashemi, Mir Sajjad, and Dumitru Baleanu. Lie Symmetry Analysis of Fractional Differential Equations. CRC Press, 2020. | | | | | | | |
| **OTHER REFERENCES** | | | | | Fractional Differential Equations: An Introduction to Fractional Derivatives ,Igor Podlubny. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Classical Lie symmetry analysis |
| 2 | Prolongation Formulas |
| 3 | Transformation Groups and Lie Bracket |
| 4 | Lie symmetries of the mKdV-KP equation |
| 5 | Basic theory of fractional calculus |
| 6 | Basic theory of fractional differential equations |
| 7 | Group analysis of fractional differential equations |
| 8 | Lie symmetries of time-fractional K(m; n) equation |
| 9 | Lie symmetry analysis of the time-fractional variant Boussinesq and coupled Boussinesq-Burger's equations |
| 10 | Lie symmetries of time-fractional Clannish Random Walker's parabolic equation |
| 11 | Lie groups of transformations for FIDEs |
| 12 | The invariance criterion for FIDEs |
| 13 | Symmetry group of FIDEs |
| 14 | Application with Maple Package program |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE MATHEMATICS-COMPUTER MSc PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | | | **3**  High | | **2**  Mid | **1**  Low |
| **LO 1** | Through scientific research in the field of reaches the knowledge widely and in-depth, evaluates, comments and applies the knowledge. | | |  | |  |  |
| **LO 2** | With current techniques and methods applied in the field has information on level of expertise of these constraints. | | |  | |  |  |
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| **LO 4** | Aware of new and developing applications related to professions, learn and examine these applications when needed. | | |  | |  |  |
| **LO 5** | Ability to formulate and ıdentify problems that are related to study field, develop methods for solving problems and apply innovative methods in solution. | | |  | |  |  |
| **LO 6** | Ability to develop new and / or original ideas and methods; design complex systems or processes and develop innovative / alternative solutions in his design. | | |  | |  |  |
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| **LO 11** | The stages of collection, interpretation, dissemination of data and all events in profession supervise social, scientific and effect values. | | |  | |  |  |
| **LO 12** | The techniques necessary for the study field, the skills and gain the ability of using modern tools on level of expertise. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Dr. Sait SAN | **Date:** | | 16.11.2020 | | | |

**Signature**:



**T.R.**

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**COURSE INFORMATION FORM**

