**COMPUTER ENGINEERING PhD 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](#C6) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 503011601 | [ADVANCED ALGORITHMS](#C16) | 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 |
| 503012001 | PhD 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 |
| 503011801 | PhD PROFICIENCY  | 30 | 0+1 | - | **C** | Turkish |
|  | Total of III. Semester  | 30 |  |  |  |  |
| **IV. Semester** |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 501011102 | THESIS PROPOSAL | 30 | 0+1 | **-** | **C** | Turkish |
|  | Total of IV. Semester  | 30 |  |  |  |  |
|  | TOTAL OF SECOND YEAR | 60 |  |  |  |  |

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| **Third Year** |
| **V. Semester** |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503011802 | PhD THESIS STUDY | 25 | 0+1 | - | **C** | Turkish |
| 503011803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | - | **C** | Turkish |
|  | Total of V. Semester  | 30 |  |  |  |  |
| **VI. Semester** |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503011802 | PhD THESIS STUDY | 25 | 0+1 | - | **C** | Turkish |
| 503011803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | - | **C** | Turkish |
|  | Total of VI. Semester  | 30 |  |  |  |  |
|  | TOTAL OF THIRD YEAR  | 60 |  |  |  |  |

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| **Fourth Year** |
| **VII. Semester** |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503011802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 503011803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | **-** | **C** | Turkish |
|  | Total of VII. Semester | 30 |  |  |  |  |
| **VIII. Semester** |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503011802 | PhD THESIS STUDY | 25 | 0+1 | **-** | **C** | Turkish |
| 503011803 | SPECIALIZATION FIELD COURSE | 5 | 3+0 | - | **C** | Turkish |
|  | Total of VIII. Semester | 30 |  |  |  |  |
|  | TOTAL OF FOURTH YEAR | 60 |  |  |  |  |

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| **Elective Courses** |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 503011602 | [RECOMMENDER SYSTEMS](#C14) | 7.5 | 3+0 | 3 | E | Turkish |
| 503011603 | [MODEL BASED SOFTWARE ENGINEERING](#C13) | 7.5 | 3+0 | 3 | E | Turkish |
| 503011604 | [INTELLIGENT SYSTEMS](#C23) | 7.5 | 3+0 | 3 | E | Turkish |
| 503011605 | [Biometric Authentication](#C25) | 7.5 | 3+0 | 3 | E | Turkish |
| 503012601 | [AUTONOMOUS SYSTEMS](#C18) | 7.5 | 3+0 | 3 | E | Turkish |
| 503012602 | [GRAPH DATA MINING AND MANAGING](#C17) | 7.5 | 3+0 | 3 | E | Turkish |
| 503012603 | [TEXT MINING](#C19) | 7.5 | 3+0 | 3 | E | Turkish |
| 503012604 | [PARALLEL PROGRAMMING](#C20) | 7.5 | 3+0 | 3 | E | Turkish |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** |  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. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 2** | Being able to have researcher qualification with occupational sense of responsibility.  | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 3** | Becoming skillful at analyzing and reporting the data obtained in scientific researches. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 4** | Gaining awareness on ethical principles at basic research methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **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** |  **COMPUTER ENGINEERING (PhD)** | **SEMESTER** |   |

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| **COURSE** |
| **CODE** |        | **TITLE** |  Model Based Software Engineering  |

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
|  **PhD** | 3  | 0  | 0  | 3  | 7.5 | COMPULSORY(   ) | ELECTIVE( x ) | Turkish |
| **CREDIT DISTRIBUTION** |
| **Basic Science** | **Basic Engineering** | **Knowledge in the discipline****[if it contains considerable design content, mark with (√)]** |
|   | x |      |
| **ASSESSMENT CRITERIA** |
| **SEMESTER ACTIVITIES** | **Evaluation Type** | **Number** | **Contribution** **( % )** |
| Midterm |   |    |
| Quiz |   |    |
| Homework | 6 | 30 |
| Project | 1 | 30 |
| Report |   |    |
| Seminar |   |    |
| Other (………) |   |    |
| **Final Examination** | 40 |
| **PREREQUISITE(S)** |  none |
| **SHORT COURSE CONTENT** |  Introduction to model based software engineering, UML, model based software engineering tools, stages of modeling process, case studies.  |
| **COURSE OBJECTIVES** |  Understanding the concepts, principles, and theories of model based software engineering, ability to use UML for software modeling, learning the stages of the model based development. |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  Learning model based software design and utilizing this information in the professional studies. |
| **LEARNING OUTCOMES OF THE COURSE** |  1. Explain concepts, principles, and theories of model based software engineering(LO2),2. Utilize the tools and methods of model-based software design in the complex software problems(LO3).  |
| **TEXTBOOK** |  1. Dennis A., Wixom B.H., and Tegarden D., Systems Analysis and Design with UML, 5th Edition, John Wiley & Sons, Inc., 2015.2. Thomas Stahl, Markus Voelter, and Krzysztof Czarnecki, Model-Driven Software Development: Technology, Engineering, Management, 2006. |
| **OTHER REFERENCES** |  -- |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  Introduction |
| 2 |  UML |
| 3 |  UML |
| 4 |  Model Based Software Enginnering Tools |
| 5 |  Model Based Software Enginnering Tools |
| 6 | Midterm Examination 1 |
| 7 |  Process & Functional Modeling |
| 8 |  Structural Modeling |
| 9 |  Behavioral Modeling |
| 10 |  Design Modeling |
| 11 | Midterm Examination 2 |
| 12 |  Case Study |
| 13 |  Case Study |
| 14 |  Case Study |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE       PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO 1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[ ]**  | **[x]**  |

**Prepared by:**       **Date:**

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** |  **COMPUTER ENGINEERING (PhD)** | **SEMESTER** |   |

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| **COURSE** |
| **CODE** |        | **TITLE** |  Recommender Systems |

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
|  **PhD** | 3  | 0  | 0  | 3  | 7.5 | COMPULSORY(   ) | ELECTIVE( x ) | Türkçe |
| **CREDIT DISTRIBUTION** |
| **Basic Science** | **Basic Engineering** | **Knowledge in the discipline****[if it contains considerable design content, mark with (√)]** |
|   | 0 |      |
| **ASSESSMENT CRITERIA** |
| **SEMESTER ACTIVITIES** | **Evaluation Type** | **Number** | **Contribution** **( % )** |
| Midterm | 1 | 30 |
| Quiz |   |    |
| Homework | 1 | 30 |
| Project |   |    |
| Report |   |    |
| Seminar |   |    |
| Other (………) |   |    |
| **Final Examination** | 40 |
| **PREREQUISITE(S)** |  Yok |
| **SHORT COURSE CONTENT** |  This Specialization covers all the fundamental techniques in recommender systems, from non-personalized and project-association recommenders through content-based and collaborative techniques. Designed to serve both the data mining expert and the data literate marketing professional, the courses offer interactive, spreadsheet-based exercises to master different algorithms |
| **COURSE OBJECTIVES** |  This course, which is designed to serve as the first course in the Recommender Systems specialization, introduces the concept of recommender systems, reviews several examples in detail, and leads you through non-personalized recommendation using summary statistics and product associations, basic stereotype-based or demographic recommendations, and content-based filtering recommendations.  |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  After completing this course, you will be able to compute a variety of recommendations from datasets using basic spreadsheet tools, and if you complete the honors track you will also have programmed these recommendations |
| **LEARNING OUTCOMES OF THE COURSE** |  In addition to detailed lectures and interactive exercises, this course features interviews with several leaders in research and practice on advanced topics and current directions in recommender systems. |
| **TEXTBOOK** |  An Introduction Recommender Systems, D. JANNACH , M. ZANKER, A. FELFERNIG, G. FRIEDRICH, Cambridge university Press, 2011 |
| **OTHER REFERENCES** |  Recommender Systems Handbook, F. Ricci, L. Rokach, B.Shapira, P. B. Kantor, springer 2011 |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  Intro to Recommender Systems |
| 2 |  Non-Personalized and Stereotype-Based Recommenders |
| 3 |  Ranking and Scoring |
| 4 |  Introduction to Content-Based Recommenders |
| 5 |  TFIDF and Content Filtering |
| 6 | Midterm Examination 1 |
| 7 |  Content-Based Recommenders Spreadsheet Assignment |
| 8 |  Tools for Content-Based Filtering |
| 9 |  User-User Collaborative Filtering |
| 10 |  Item-Item Collaborative Filtering Recommenders |
| 11 | Midterm Examination 2 |
| 12 |  Recommender Systems: Evaluation and Metrics |
| 13 |  Matrix Factorization and Advanced Techniques |
| 14 |  Application of Recommender Systems  |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE       PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO 1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[ ]**  | **[x]**  |

**Prepared by:** Yrd.Doç.Dr.Kemal ÖZKAN **Date:** 07.04.2017

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** |  **COMPUTER ENGINEERING (PhD)** | **SEMESTER** |   |

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| **COURSE** |
| **CODE** |        | **TITLE** |  Advanced algorithms  |

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
|  **PhD** | 3  |    |    | 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 |   | 50 |
| Seminar |   |    |
| Other (………) |   |    |
| **Final Examination** | 50 |
| **PREREQUISITE(S)** |  Calculus Algorithms and complexities |
| **SHORT COURSE CONTENT** |  interpolation, curve approximation,lineer programlama,prime algorithms and approximation algorithms |
| **COURSE OBJECTIVES** |  writing and designing algorithms in various fields  |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  gaining ability to wtite program  |
| **LEARNING OUTCOMES OF THE COURSE** |  leraning tecniques to write algorithms in some fields  |
| **TEXTBOOK** |  Advanced Algorithms Lecture Notes Periklis A. Papakonstantinou  |
| **OTHER REFERENCES** |  1Curves and Surfaces for Computer Graphics, David Soloman2 Introduction to algorithms, Thomas H. Cormen  |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  interpolation:lineer and spline interpolation |
| 2 |  bezier approximation |
| 3 |  bezier approximation |
| 4 |  B-spline approximation |
| 5 |  B-spline approximation |
| 6 | Midterm Examination 1 |
| 7 |  probabilistic algorithms |
| 8 |  lineer programlama |
| 9 |  lineer programlama |
| 10 |  prime algorithms |
| 11 | Midterm Examination 2 |
| 12 |  Prime algorithms |
| 13 |  Approximation algorithms  |
| 14 |  Approximation Algorithms  |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE COMPUTER ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO 1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[ ]**  | **[x]**  |

**Prepared by:** idiris Dağ **Date:** 6.4.2017

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** |  **COMPUTER ENGINEERING (PhD)** | **SEMESTER** |   |

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| **COURSE** |
| **CODE** |        | **TITLE** |  Graph Data Mining and Managing  |

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
|  **PhD** | 3  | 0  | 0  | 3  | 7,5 | COMPULSORY(   ) | ELECTIVE( X ) | Turkish |
| **CREDIT DISTRIBUTION** |
| **Basic Science** | **Basic Engineering** | **Knowledge in the discipline****[if it contains considerable design content, mark with (√)]** |
| 1 | 2 |      |
| **ASSESSMENT CRITERIA** |
| **SEMESTER ACTIVITIES** | **Evaluation Type** | **Number** | **Contribution** **( % )** |
| Midterm | 1 | 20 |
| Quiz |   |    |
| Homework | 4 | 20 |
| Project | 2 | 20 |
| Report |   |    |
| Seminar |   |    |
| Other (………) |   |    |
| **Final Examination** | 40 |
| **PREREQUISITE(S)** |        |
| **SHORT COURSE CONTENT** |  Graph Data Management Algorithms, Graph Mining Algorithms, Exact and Inexact Graph Matching, Graph Classification and Clustering, Mining Graph Patterns, Graph Mining Techniques for Biological Datasets |
| **COURSE OBJECTIVES** |  Students able to use of the data mining and managing processing techniques on the graph. |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  To learn the analysis of graphs and to develop software with the results obtained. |
| **LEARNING OUTCOMES OF THE COURSE** |  Using Graph Management Algorithm (LO2)Using Graph Mining Algorithm (LO3)Using Graph Matching (LO3)Using Classification and Clustering on Graph (LO2)Using Graph Mining Techniques for Biological Datasets (LO4) |
| **TEXTBOOK** |  [1] Aggarwal, C. C., Wang, H.: Managing and Mining Graph Data, 2010 |
| **OTHER REFERENCES** |  [2] Koller, D., Friedman, N.: Probabilistic Graphical Models, The MIT Press, 2009.  |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  Graph Data Management and Mining: A Survey of Algorithms and Application |
| 2 |  Graph Mining: Laws and Generators |
| 3 |  Graph Indexing, Graph Reachability Queries: A Survey |
| 4 |  Exact and Inexact Graph Matching: Methodology and Applications |
| 5 |  A Survey of Algorithms for Keyword Search on Graph Data |
| 6 | Midterm Examination 1 |
| 7 |  A Survey of Clustering Algorithms for Graph Data |
| 8 |  A Survey of Algorithms for Dense Subgraph Discovery |
| 9 |  Graph Classification and Mining Graph Patterns |
| 10 |  A Survey of Privacy-Preservation of Graphs and Social Networks |
| 11 | Midterm Examination 2 |
| 12 |  Survey of Graph Mining for Web Applications |
| 13 |  Graph Mining Applications to Social Network Analysis |
| 14 |  Graph Mining Techniques for Biological Datasets |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE COMPUTER ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO 1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[x]**  | **[ ]**  |

**Prepared by:** Assoc. Prof.Dr.Eyyüp GÜLBANDILAR **Date:** 15.11.2017

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** |
| **CODE** |  5030 | **TITLE** |  Autonomous Systems |

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
|  **PhD** | 3  | 0  | 0  | 3  | 7.5 | COMPULSORY(   ) | ELECTIVE( x ) | Turkish |
| **CREDIT DISTRIBUTION** |
| **Basic Science** | **Basic Engineering** | **Knowledge in the discipline****[if it contains considerable design content, mark with (√)]** |
| 0 | 3 |      |
| **ASSESSMENT CRITERIA** |
| **SEMESTER ACTIVITIES** | **Evaluation Type** | **Number** | **Contribution** **( % )** |
| Midterm | 1 | 25 |
| Quiz |   |    |
| Homework |   |    |
| Project | 1 | 35 |
| Report |   |    |
| Seminar |   |    |
| Other (………) |   |    |
| **Final Examination** | 40 |
| **PREREQUISITE(S)** |  - |
| **SHORT COURSE CONTENT** |  Introduction and basic concepts of Autonomous Systems, System Components;Control and Decision Making, Perception, Knowledge Representation and Learning, Interaction and Collaboration, Problems and solutions, the social impacts and ethical issues of Autonomous Systems, |
| **COURSE OBJECTIVES** |  At the end of the course, the participant is expected to understand the basic concepts of Autonomous Systems. Additionally, it is expected to model and solve some realworld problems using the approaches for the Autonomous Systems. It is also expected to be aware of the social impacts and ethical issues of Autonomous Systems. |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  Modeling some realworld problems using Autonomous Systems |
| **LEARNING OUTCOMES OF THE COURSE** |  1.Ability to define concepts related Autonomous Systems(LO2).2. Autonomous Systems and component desgin for some problems(LO2, LO3)3. Combine the results of the studies, comments on them, discuss in the team, and report the results. Present and defense the studies(LO5).4. Analysis of the social impacts and ethical issues of Autonomous Systems (LA6, LA7)  |
| **TEXTBOOK** |  1)Alain Cardon, Mhamed Itmi, New Autonomous Systems, April 2016, Wiley-ISTE |
| **OTHER REFERENCES** |  2)Jitendra R. Raol, Ajith K. Gopal, Mobile Intelligent Autonomous Systems,2017 by CRC Press  |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  Introduction |
| 2 |  Conventional Systems |
| 3 |  Complex and large scale systems |
| 4 |  Agents- Multi-Agent systems |
| 5 |  Perception |
| 6 | Midterm Examination 1 |
| 7 |  Perception |
| 8 |  Control and Decision Making |
| 9 |  Control and Decision Making |
| 10 |  Knowledge Representation and Learning |
| 11 | Midterm Examination 2 |
| 12 |  Knowledge Representation and Learning |
| 13 |  Interaction with other systems |
| 14 |  Integration of the Autonomous Systems to the social life |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE COMPUTER ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO 1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[ ]**  | **[ ]**  | **[ ]**  |
| **LO 2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[ ]**  | **[ ]**  |
| **LO 5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[x]**  | **[ ]**  |

**Prepared by:** Assoc.Prof.Dr.Ahmet YAZICI **Date:** 15.11.2017

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** |  **COMPUTER ENGINEERING (PhD)** | **SEMESTER** |   |

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| **COURSE** |
| **CODE** |        | **TITLE** |  TEXT MINING |

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
|  **PhD** | 3  | 0  |    | 3  | 7.5 | COMPULSORY(   ) | ELECTIVE( X ) | Türkçe |
| **CREDIT DISTRIBUTION** |
| **Basic Science** | **Basic Engineering** | **Knowledge in the discipline****[if it contains considerable design content, mark with (√)]** |
| 1 | 2 |      |
| **ASSESSMENT CRITERIA** |
| **SEMESTER ACTIVITIES** | **Evaluation Type** | **Number** | **Contribution** **( % )** |
| Midterm | 1 | 30 |
| Quiz |   |    |
| Homework | 1 | 20 |
| Project |   |    |
| Report |   |    |
| Seminar |   |    |
| Other (………) |   |    |
| **Final Examination** | 50 |
| **PREREQUISITE(S)** |  - |
| **SHORT COURSE CONTENT** |  Introduction to Text Mining,Natural Language Prorocess, Document Representation, Information extraction from document, Preprocessing in document analysis, Feature Extraction and dimensionality reduction, Text classification, text, clustering, text summarization, text visualization, Case Studies |
| **COURSE OBJECTIVES** |  This course aims to provide basic knowledge and methods on text mining discipline and introduce the algorithms that are experienced on data analysis and applications to the real life problems. |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  With the help of this course, the data belongining to real-life problems can be interpreted by data mining methods and will help for process improvements. |
| **LEARNING OUTCOMES OF THE COURSE** |  1. Interpretation of the relationships between data set-attributes with the help of text mining techniques on the document.Classification of unknown samples by determining the decision rule for known samples(LO1).2. To have knowledge on up to date techniques in the field of text mining (LO3).3. To employ text mining techniques to the data that can be obtained from various disciplines(LO6).4. Presenting and reporting the results of the term project in comparison to the results of the related work in the literature (LO7).  |
| **TEXTBOOK** |  Text Mining:Applications and Theory, Michael W. Berry, Jacob Kogan,(WILEY) |
| **OTHER REFERENCES** |  Fundamentals of Predictive Text Mining, Sholom M. Weiss, Nitin Indurkhya, Tong Zhang (Springer)  |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  Introduction to Text Mining |
| 2 |  Natural Language Processing |
| 3 |  Document Representation  |
| 4 |  Information Extraction from Document |
| 5 |  Preprocessing in Document Analysis |
| 6 | Midterm Examination 1 |
| 7 |  Feature Extraction and Dimensionality Reduction |
| 8 |  Text Classification |
| 9 |  Text Clustering |
| 10 |  Text Summarization |
| 11 | Midterm Examination 2 |
| 12 |  Text Visualization |
| 13 |  Case Studies( Sentiment Analysis, Social Media and Network Analysis,Web Mining etc.) |
| 14 |  Case Studies( Sentiment Analysis, Social Media and Network Analysis,Web Mining etc.) |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE COMPUTER ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO 1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[x]**  | **[ ]**  |

**Prepared by:** Dr. Efnan ŞORA GÜNAL

**Date:** 15.11. 2017

S**ignature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** |  **COMPUTER ENGINEERING (PhD)** | **SEMESTER** |   |

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

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
|  **PhD** | 3  |    |    | 3  | 7.5 | COMPULSORY(   ) | ELECTIVE( x ) | Turkish |
| **CREDIT DISTRIBUTION** |
| **Basic Science** | **Basic Engineering** | **Knowledge in the discipline****[if it contains considerable design content, mark with (√)]** |
|   |   |  3  |
| **ASSESSMENT CRITERIA** |
| **SEMESTER ACTIVITIES** | **Evaluation Type** | **Number** | **Contribution** **( % )** |
| Midterm | 1 | 25 |
| Quiz |   |    |
| Homework |   |    |
| Project | 1 | 15 |
| Report |   |    |
| Seminar |   |    |
| Other (………) | 1 | 20 |
| **Final Examination** | 40 |
| **PREREQUISITE(S)** |        |
| **SHORT COURSE CONTENT** |  Parallel computing techniques (embarrassingly parallel computations, Partitioning and divide and conquer, pipelined computations, synchronous computations) and algorithms (searching algorithms, numerical algorithms, image processing algorithms) will be discussed. Students will have practical experiences writing parallel programs on a cluster of computers. We will concentrate upon the message-passing method of parallel computing and use the standard parallel computing tool MPI (Message Passing Interface). Thread-based programming will also be outlined. |
| **COURSE OBJECTIVES** |  The students should be able to 1. define parallel computer architectures, 2.use various parallel programming techniques such as data parallelism, data sharing, 3. define the sources for the performance degradation such as extremely consecutive coding, process execution time, communication delay, load imbalance in parallel programs, 4. acquire the knowledge and skills required for developing parallel programs by applying the alternatives determined by the computer architecture, debugging and trying. |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  1.Learn Parallel Programming techniques 2.Developing applications on Beowulf cluster 3.Develop applications with MPI |
| **LEARNING OUTCOMES OF THE COURSE** |  1.Being able to classify and compare parallel computer architectures,(LO1) 2.Being able to develop message passing programs,(LO1) 3.Being able to understand accelaration, efficiency and scalability of parallel programs, (LO1) 4.Being able to analyze the complexity of parallel programs, (LO1) 5.Being able to understand and use basic MPI programming techniques,(LO1,LO2) 6.Being able to convert sequential algorithms to parallel programs, (LO1,LO2) 7.Being able to design parallel algorithms, (LO1,LO2) 8.Being able to develop parallel programs that can run on cluster computer environments, (LO1,LO2) 9.Being able to realize group projects,(LO4) 10.Being able to make presentations (LO4) |
| **TEXTBOOK** |  Course Notes, Parallel Programming: Techniques and Application Using Networked Workstations and Parallel Computers, by B. Wilkinson and M. Allen, Prentice Hall Inc., 1999, ISBN 0-13-671710-1. |
| **OTHER REFERENCES** |  Beowulf cluster with MPI |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  Classification of parallel computers Parallel architectures |
| 2 |  Message Passing Programming (MPI) |
| 3 |  Grouping data for communication |
| 4 |  Communicators and Topologies, Dealing with I/O |
| 5 |  Evaluation of parallel programs |
| 6 | Midterm Examination 1 |
| 7 |  Design and Coding paralel programs |
| 8 |  Debugging your program and performance |
| 9 |  Embarrassingly Parallel Computations |
| 10 |  Partitioning and Divide and concouer startegies |
| 11 | Midterm Examination 2 |
| 12 |  Pipelined computations |
| 13 |  Load Balancing and Termination Detection |
| 14 |  Project Presentations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE COMPUTER ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO 1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO 7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[ ]**  | **[x]**  |

**Prepared by:** Asst.Prof.Dr. Nihat Adar **Date:** 15.11.2017

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** |
| **CODE** |  5030 | **TITLE** |  Intelligent Systems |

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
|  **PhD** | 3  | 0  | 0  | 3  | 7.5 | COMPULSORY(   ) | ELECTIVE( x ) | Turkish |
| **CREDIT DISTRIBUTION** |
| **Basic Science** | **Basic Engineering** | **Knowledge in the discipline****[if it contains considerable design content, mark with (√)]** |
| 0 | 3 |      |
| **ASSESSMENT CRITERIA** |
| **SEMESTER ACTIVITIES** | **Evaluation Type** | **Number** | **Contribution** **( % )** |
| Midterm | 1 | 25 |
| Quiz |   |    |
| Homework |   |    |
| Project | 1 | 35 |
| Report |   |    |
| Seminar |   |    |
| Other (………) |   |    |
| **Final Examination** | 40 |
| **PREREQUISITE(S)** |  - |
| **SHORT COURSE CONTENT** |  Introduction Intelligent Systems; Problems and solutions, Classification of Search Algorithms, Knowledge Representation, Learning, Other methods and applications to implement Intelligent Systems, the social impacts and ethical issues of Intelligent systems, |
| **COURSE OBJECTIVES** |  At the end of the course, the participant is expected to understand the basic concepts of Intelligent Systems. Additionally, it is expected to model and solve some realworld problems using the approaches for the Intelligent Systems. It is also expected to be aware of the social impacts and ethical issues of Intelligent Systems. |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  Developing Intelligent systems for some realworld problems. |
| **LEARNING OUTCOMES OF THE COURSE** |  1.Ability to define concepts related Intelligent Systems(LO2).2. Intelligent Systems and component desgin for some problems(LO2, LO3)3. Combine the results of the studies, comments on them, discuss in the team, and report the results. Present and defense the studies(LO5).4. Analysis of the social impacts and ethical issues of Intelligent Systems (LA6, LA7)  |
| **TEXTBOOK** |  S. Russell and P. Norvig, "Artificial Intelligence A Modern Approach", Third Edition, Pearson, 2014. |
| **OTHER REFERENCES** |  M.Negnevitsky, Artificial Intelligence : A Guide to Intelligent Systems, Third Edition, Addison Wesley, 2011.       |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  Introduction to Intelligent Systems |
| 2 |  Problems and Modeling Approaches |
| 3 |  Some problems and blind search methods |
| 4 |  Informed Search Algorithms |
| 5 |  Local Search Algorithms |
| 6 | Midterm Examination 1 |
| 7 |  Project Presentations I, Logical Agents      |
| 8 |  Knowledge Representation |
| 9 |  First Order Logic |
| 10 |  Inference using First Order Logic |
| 11 | Midterm Examination 2 |
| 12 |  Project Presentations II |
| 13 |  Intelligent System Applications |
| 14 |  Integration of the Intelligent Systems to the social life |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE COMPUTER ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO 1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[ ]**  | **[ ]**  | **[ ]**  |
| **LO 2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO 3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[ ]**  | **[ ]**  |
| **LO 5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO 7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[x]**  | **[ ]**  |

**Prepared by:** Assoc.Prof.Dr.Ahmet YAZICI **Date:** 23.03.2018

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **COMPUTER ENGINEERING (PhD)** | **SEMESTER** |   |

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| **COURSE** |
| **CODE** |        | **TITLE** |  Biometric Authentication |

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| **LEVEL** | **HOUR/WEEK** | **Credit** | **ECTS** | **TYPE** | **LANGUAGE** |
| **Theory** | **Practice** | **Laboratory** |
| **PhD** | 3  | 0  | 0  | 3  | 7,5 | COMPULSORY(   ) | ELECTIVE( X ) | Turkish |
| **CREDIT DISTRIBUTION** |
| **Basic Science** | **Basic Engineering** | **Knowledge in the discipline****[if it contains considerable design content, mark with (√)]** |
|   |   |      |
| **ASSESSMENT CRITERIA** |
| **SEMESTER ACTIVITIES** | **Evaluation Type** | **Number** | **Contribution** **( % )** |
| Midterm | 1 | 20 |
| Quiz |   |    |
| Homework | 4 | 20 |
| Project | 1 | 30 |
| Report |   |    |
| Seminar |   |    |
| Other (     ) |   |    |
| **Final Examination** | 30 |
| **PREREQUISITE(S)** |  - |
| **SHORT COURSE CONTENT** |  Biometric Identity Verification is a course that gives the knowledge that people can be identified biometrically. The course begins by introducing existing authentication technologies, analyzing them and showing their strengths and weaknesses, then covers the main steps for building any biometric authentication system. |
| **COURSE OBJECTIVES** |  To understand the state-of-the-art in biometric system technologies;To survey the currently available biometric systems;To explore ways to improve some of the current techniques;To learn and implement some of the biometrics authentication;To explore new techniques; |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** |  Training computer engineers to have experts in biometric systems and biometric authentication to be able to work on identity verification for information security. |
| **LEARNING OUTCOMES OF THE COURSE** |  1. Students will gain a basic understanding on the basic principles of biometric authentication systems and how they work (LO:1)2. Students will be able to analyze a biometric authentication system (LO:2)3. Students will be able to compare different biometric systems and provide reasons why a particular biometric system is better than others (LO:1, 2)4. Students will be aware of the resources to review scientific articles in the field of biometric authentication and to follow the latest developments in the field (LO:2)5. Students will develop and implement a biometric authentication system (LO:3, 4)6. With the project, each student can access expertise on a subject related to the subject of the course (LO:1,2,3,4,6) |
| **TEXTBOOK** |  Course HandoutsReading material and papers will be provided |
| **OTHER REFERENCES** |  • Security and Privacy in Biometrics, Patrizio Campisi, Springer, 2003. •Introduction to Biometrics, Anil K. Jain, Arun A. Ross, Karthhik Nandakumar, Springer, ISBN: 978-0-387-77325-4 , 2011. •Biometric Systems: Technology, Design and Performance Evaluation, by James L. Wayman, Anil K. Jain, Davide Maltoni, and Dario Maio, 2004. •Biometric Technologies and Verification Systems, by John R. Vacca, 2007 • Ashbourn, J. Biometrics: Advanced Identity Verification, Ashbourn, J., Springer, 2000. |

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| **COURSE SCHEDULE (Weekly)** |
| **WEEK** | **TOPICS** |
| 1 |  Introduction to biometric authentication |
| 2 |  Biometric systems, sensors and features |
| 3 |  Biometric system types (Physiological/Behavioral) |
| 4 |  Fingerprint recognition |
| 5 |  Face recognition |
| 6 |  Signature recognition |
| 7 |  Voice recognition |
| 8 |  Midterm Exam |
| 9 |  Performance evaluations |
| 10 |  Multimodal biometric systems |
| 11 |  Biometrics standards |
| 12 |  Biometric security and privacy |
| 13 |  Project Presentations |
| 14 |  Project Presentations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE COMPUTER ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | **CONTRIBUTION LEVEL** |
| **NO** | **LEARNING OUTCOMES (PhD)**  | **3**High | **2**Mid | **1**Low |
| **LO1** | Ability to apply knowledge of mathematics, basic sciences and engineering in expertise level in Computer Engineering and other related areas. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO2** | Having extensive knowledge about contemporary techniques and methods applied in engineering, and ability to learn and apply new methods. | **[x]**  | **[ ]**  | **[ ]**  |
| **LO3** | Developing new and original ideas and methods; ability to develop innovative/alternative solutions in systems, component or process design. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO4** | Ability to work effectively in interdisciplinary and multidisciplinary teams, making leadership of these kind of teams. Ability to work independently an taking responsibility. | **[ ]**  | **[x]**  | **[ ]**  |
| **LO5** | Use a foreign language at an advanced level, and ability to communicate in oral and written forms. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO6** | Awareness of social, environmental, health, safety, and legal issues of engineering applications and, ability to make critical analysis and evaluation of new ideas and developments. | **[ ]**  | **[ ]**  | **[x]**  |
| **LO7** | Advanced level of Professional and ethical responsibility. | **[ ]**  | **[ ]**  | **[x]**  |
| **Prepared by :**  |  Dr. Öğr. Üyesi Esra N. Yolaçan | **Date:** |  10/06/2021 |

**Signature**: