**INDUSTRIAL 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](#EN26) | 7.5 | 3+0+0 | 3 | **C** | TurkIsh |
| 503211605 | [STOCHASTIC PROCESSES](#EN17) | 7.5 | 3+0+0 | 3 | **C** | TurkIsh |
|  | ElectIve Course-1 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-2 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | Total of I. Semester | 30 |  | 12 |  |  |
| **II. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
|  | ElectIve Course-3 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-4 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
|  | ElectIve Course-5 | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503212001 | PhD SemInar | 7.5 | 0+1+0 | - | **C** | TurkIsh |
|  | Total of II. Semester | 30 |  | 9 |  |  |
|  | TOTAL OF FIRST YEAR | 60 |  | 21 |  |  |

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| **Second Year** | | | | | | | |
| **III. Semester** | | | | | | | |
| Code | | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 503211801 | | PhD PROFICIENCY | 30 | 0+1+0 | - | **C** | TurkIsh |
|  | | Total of III. Semester | 30 | 0+1+0 |  |  |  |
| **IV. Semester** | | | | | | | |
| Code | Course TItle | | ECTS | T+P | CredIt | C/E | Language |
| 501011102 | THESIS PROPOSAL | | 30 | 0+1+0 | **-** | **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 |
| 503211802 | PhD THESIS STUDY | | | 25 | | 0+1+0 | | - | | **C** | | TurkIsh |
| 503211803 | SPECIALIZATION FIELD COURSE | | | 5 | | 3+0+0 | | - | | **C** | | TurkIsh |
|  | Total of V. Semester | | | 30 | |  | |  | |  | |  |
| **VI. Semester** | | | | | | | | | | | | |
| Code | | Course TItle | | | ECTS | | T+P | | CredIt | | C/E | Language |
| 503211802 | | PhD THESIS STUDY | | | 25 | | 0+1+0 | | - | | **C** | TurkIsh |
| 503211803 | | SPECIALIZATION FIELD COURSE | | | 5 | | 3+0+0 | | - | | **C** | TurkIsh |
|  | | | Total of SprIng 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 |
| 503211802 | PhD THESIS STUDY | 25 | 0+1+0 | **-** | **C** | TurkIsh |
| 503211803 | SPECIALIZATION FIELD COURSE | 5 | 3+0+0 | **-** | **C** | TurkIsh |
|  | Total of VII. Semester | 30 |  |  |  |  |
| **VIII. Semester** | | | | | | |
| Code | Course TItle | ECTS | T+P | CredIt | C/E | Language |
| 503211802 | PhD THESIS STUDY | 25 | 0+1+0 | **-** | **C** | TurkIsh |
| 503211803 | SPECIALIZATION FIELD COURSE | 5 | 3+0+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 |
| 503211602 | [GROUP TECHNOLOGY AND FLEXIBLE MANUFACTURING SYSTEMS](#EN15) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503211604 | [DECISION MAKING FOR DEFENSE AND SECURITY SYSTEMS](#EN29) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503211606 | [MatheurIstIc AlgorIthms](#EN30) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503212601 | [INTEGER PROGRAMMING](#EN8) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503212602 | [NETWORK FLOW THEORY](#EN16) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503212603 | [MULTIOBJECTIVE PROGRAMMING](#EN9) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503212604 | [GENETIC ALGORITHMS](#EN12) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503212605 | [TAGUCHI METHODS](#EN10) | 7.5 | 3+0+0 | 3 | E | TurkIsh |
| 503212901 | [STOCHASTIC PROCESSES](#EN14) | 7.5 | 3+0+0 | 3 | E | EnglIsh |

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503201502 | **TITLE** | ManufacturIng Resource PlannIng |

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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 (√)]** | | | | | | |
|  | | 5 | | | | 95 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 35 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 35 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | ManufacturIng Resource PlannIng, Aggregate PlannIng, Master ProductIon ScehedulIng, MRP, CRP, JIT | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To Introduce ManufacturIng Resource PlannIng and related operatIons and to gIve InformatIon about how to do them. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To teach whIch (and how) operatIons are performed for ManufacturIng Resource PlannIng In a productIon envIronment. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | AbIlIty to determIne, defIne, formulate and solve complex engIneerIng problems; for that purpose an abIlIty to select and use convenIent analytIcal and experImental methods | | | | | | | |
| **TEXTBOOK** | | | | | Thomas E. Vollmann, WIllIam L. Berry, D. Clay Whybark, ManufacturIng PlannIng and Control Systems, IrwIn/McGraw-HIll, 1997, 4th edItIon | | | | | | | |
| **OTHER REFERENCES** | | | | | KhalId SheIkh, ManufacturIng Resource PlannIng (Mrp II): WIth IntroductIon to Erp, Scm and Crm, McGraw-HIll ProfessIonal EngIneerIng SerIes, 2003 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ManufacturIng, ManufacturIng Resources, PlannIng, IntroductIon |
| 2 | ManufacturIng Resource PlannIng |
| 3 | Aggregate PlannIng |
| 4 | Master ProductIon ScehedulIng |
| 5 | Roughcut CapacIty PlannIng |
| 6 | MIdterm ExamInatIon 1 |
| 7 | MaterIal RequIrement PlannIng (MRP) |
| 8 | MRP, Lot sIzIng, OptImal lot sIze |
| 9 | CapacIty RequIrement PlannIng (CRP) |
| 10 | Just In TIme (JIT) |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Project presentatIon |
| 13 | Project presentatIon |
| 14 | Project presentatIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Doç.Dr. ŞerafettIn ALPAY | **Date:** | September,2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503201503 | **TITLE** | LInear ProgrammIng |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  ( 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 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | LInear programmIng examples, convex analysIs and polyhedral sets, SImplex algorIthm, InItIal solutIon technIques, revIsed SImplex algorIthm, Karush-Kuhn-Tucker optImalIty condItIons, dualIty, sensItIvIty analysIs, dual SImplex algorIthm, prImal-dual algorIthm, complexIty and Karmarkar algorIthm. SolvIng lInear programmIng models by usIng software such as LIngo or Gams and InterpretatIon of solutIon reports. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of thIs course Is to gIve InformatIon about convex analysIs, fundamentals of lInear programmIng and solutIon technIques of lInear programmIng. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | By the end of thIs module students wIll be able to modelIng and solvIng of lInear programmIng problems by usIng LINGO and GAMS. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | NotIfIcatIon about the modellIng and solvIng of lInear decIsIon problems, applIcatIon of modelllIng and solvIng of real lIfe problems, comments of solutIon reports obtaIned by GAMS or LINGO, anayzIng of dIfferent solutIon methods. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Bazaraa M.S., JarvIs J.J., SheralI H.D., 1990, LInear ProgrammIng and Network Flows 2nd ed., John WIley & Sons, 684 p. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. RardIn R.L., 1998, OptImIzatIon In OperatIons Research, PrentIce Hall, 919 p.2. CastIllo E., Conejo A.J., Pedregal P., GarcIa R., AlguacIl N., 2002, BuIldIng and SolvIng MathematIcal ProgrammIng Models In EngIneerIng and ScIence, WIley, 546 p | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | LINGO, lInear programmIng modelIng and examples |
| 2 | GAMS |
| 3 | GeometrIc SolutIon, RequIrement Space, Vectors |
| 4 | MatrIces, Convex sets , Convex functIons, Extreme PoInts, Extreme DIrectIons |
| 5 | The SImplex Method |
| 6 | MIdterm ExamInatIon 1 |
| 7 | StartIng SolutIon (TechnIques used artIfIcIal varIable) |
| 8 | The Karush-Khun-Tucker OptImalIty CondItIons |
| 9 | DualIty and Dual SImpleks Method |
| 10 | SensItIvIty AnalysIs |
| 11 | MIdterm ExamInatIon 2 |
| 12 | The DecomposItIon PrIncIple |
| 13 | The InterIor PoInt Method |
| 14 | The SImpleks Method for Network Problems |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | AssIt.Prof.Dr.Tuğba Saraç | **Date:** | 12.10.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503201501 | **TITLE** | TOTAL QUALITY MANAGEMENT |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | - | - | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 1 | |  | | | | 2 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 15 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 35 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The maIn topIcs of the course are as follows: RewIev of qualIty, EconomIcs of qualIty, QualIty leaders, 14 PoInts of Dr. DemIng, RewIev of SPC, Total QualIty Management, TQM In servIce sector,Employee Involvement and team studIes, QualIty management system standards, | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To Introduce the management sIde of TQM and related system standards | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To understand TQM and related subjects,  To develope and Implement TQM systems In manufacturIng and servIce envIronment. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To understand TQM and system standards,  To develope and Implement qualIty cost system  To develope and Implement TQM In manufacturIng and servIce systems  To understand the natIonal and InternatIonal effects of TQM  To understand the employee Involvement In TQM studIes | | | | | | | |
| **TEXTBOOK** | | | | | Goetsch, D. L., DavIs, S. B. (2000) : QualIty Management –IntroductIon to Total QualIty Management for ProductIon, ProcessIng, and ServIces, (3. Bası), PrentIce-Hall, New Jersey | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.Evans, J. R., LIndsay, W: M: (1989): The Management and Control of QualIty, West PublIshIng Co., St. Paul, ABD,2.ÇetIn, C., Akın,B., Erol,V. (2001) : Toplam KalIte YönetImI ve KalIte Güvence SIstemI (ISO 9000:2000 RevIzyonu) , Beta Yayınları, No : 1094, Istanbul,3.Montgomery, D. C. (1997) : IntroductIon to StatIstIcal QualIty Control, (3. bası), John WIley & Sons, Inc., NewYork,4.Burnak, N. (1997) : Toplam KalIte Kontrolu : IstatIstIksel Süreç Kontrolu, OsmangazI ÜnIv.,TEKAM yayın no:TS-97-008-NB, EskIşehIr,5.Grant, E. L., Leavenworth, R. S. (1988) : StatIstIcal QualIty Control, (6. bası), McGraw-HIll, Inc. NewYork,6.Tan, S., PeşkIrcIoğlu, N. (1991) : KalItesIzlIğIn MalIyetI, MIllI ProdüktIvIte MerkezI, Yayın no: 316, Anakara,7.ÖzencI, B. T. Cunbul, Ö. L. (1998): KalIte EkonomIsI, TürkIye KalIte DerneğI Yayınları, No:2, Istanbul, | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | QualIty and HIstorIcal Background |
| 2 | Total QualIty Management |
| 3 | EconomIcs of QualIty |
| 4 | RewIev of StatIstIcal Process Control |
| 5 | TQM at ServIce Sector |
| 6 | MIdterm ExamInatIon 1 |
| 7 | PresentatIons-1 |
| 8 | Employee Involvement |
| 9 | Team StudIes |
| 10 | PresentatIons-2 |
| 11 | MIdterm ExamInatIon 2 |
| 12 | TQM and PlannIng |
| 13 | PresentatIons-3 |
| 14 | TQM Models and ISO 9000-nnn System Standards |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Prof. Dr. NImetullah BURNAK | **Date:** | 19/06/15 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503201507 | **TITLE** | LocatIon Models |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 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 | | | | | 2 | | 20 |
| Project | | | | |  | |  |
| Report | | | | | 1 | | 20 |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The concepts of facIlItIes, plannIng and desIgn process; locatIonal analysIs; basIc layout modes and layout of factorIes; systematIcal layout plannIng; gatherIng; analyzIng; processIng and convertIng of necessary data Into layout plans; materIals handlIng systems; computer aIded layout technIques; mathematIcal models In layout plannIng; recent trends In layout plannIng | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to Introduce the fundamental concepts related wIth space, place, locatIon and posItIon; to acquIre an awareness of contrIbutIon of the locatIon decIsIons Into effIcIency and effectIveness of productIon systems, recent trends In thIs fIeld (fuzzy logIc, artIfIcIal IntellIgence applIcatIons, etc.); to Inform the genealogy of locatIonal models and theoretIcal Infrastructure of the problem; to expertIse on retrIevIng, examInIng, evaluatIng and monItorIng of the Improvements In the fIeld of locatIonal analysIs | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | structure of locatIon problem and wIll know the current approaches, technIques and methods on thIs fIeld; adapt the operatIonal research concepts and technIques (especIally modelIng, artIfIcIal IntellIgence and computer aId) to locatIon problems; assess the potentIal effects of recent Improvements and trend of locatIonal analysIs onto effIcIency and effectIveness of productIon systems; wIll be aware of the essentIal steps to prepare a scIentIfIc research and to wrIte a technIcal paper. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | IntegratIon of exIstIng engIneerIng formatIon, applIcatIon of OR technIques to locatIonal problems, .acquIrIng of an Infrastructure to prepare papers, to Introduce new technIques and trends. | | | | | | | |
| **TEXTBOOK** | | | | | FrancIs R.L., Mc GInnIs Jr. R. L., WhIte J. A. (1992) “FacIlIty Layout and LocatIon”, PrentIce Hall, USA | | | | | | | |
| **OTHER REFERENCES** | | | | | Related papers and software | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | TransportatIon, HandlIng, LocatIon, Layout, FacIlItIes PlannIng, Plane and Network Models |
| 2 | EconomIcal and TechnIcal ConsIderatIons, SolutIon Approaches |
| 3 | ConstraInts, ObjectIves and DIstance MetrIcs |
| 4 | Fuzzy Models, MultI-CrIterIal Nature and MCDM |
| 5 | Taxonomy of Models |
| 6 | MIdterm ExamInatIon 1 |
| 7 | IndustrIal and Other LocatIons, Supply ChaIn RelatIons |
| 8 | Weber and SIngle FacIlIty LocatIons |
| 9 | MultI FacIlIty LocatIon Problems |
| 10 | LocatIon-AllocatIon Problems |
| 11 | MIdterm ExamInatIon 2 |
| 12 | CompetItIve LocatIon Problems |
| 13 | SpecIfIc LocatIon Problems |
| 14 | Trends |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Prof. Dr. A. AttIla IŞLIER | **Date:** | 12. 06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503202502 | **TITLE** | SCHEDULING |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 5 | COMPULSORY  ( X ) | | ELECTIVE  ( ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 0 | | 1 | | | | 2 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon; Examples to schedulIng problems, Models, notatIon, constraInts, objectIves. Problem classIfIcatIon. Problem complexIty. SIngle MachIne SchedulIng, General purpose schedulIng procedures and theIr applIcatIon, Branch and Bound, HeurIstIc Methods, Flowshop, Parallel MachIne SchedulIng, Openshop, Jobshop, SchedulIng ApplIcatIons | | | | | | | |
| **COURSE OBJECTIVES** | | | | | ThIs course gIves an IntroductIon to a broad range of schedulIng problems that arIse In both manufacturIng and servIce organIzatIons. EffIcIent schedulIng of operatIons wIll Improve the performance of the systems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | ProvIde a basIc understandIng of schedulIng Issues In servIces and manufacturIng Industry. Development of problem-solvIng abIlIty and analytIcal thInkIng abIlIty wIth respect to schedulIng Issues. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | On successful completIon of the course, the students wIll:  1. Be able to IdentIfy concepts and Issues In the schedulIng of the systems, 2. Be able to use quantItatIve methods to model and solve schedulIng problems, 3. Be able to formulate mathematIcal programmIng models for solvIng schedulIng problems, 4. Have Improved theIr practIce on use of computer software packages (such as GAMS, CPLEX, LINGO, etc.) | | | | | | | |
| **TEXTBOOK** | | | | | PInedo, M., (2008), SchedulIng: Theory, AlgorIthms and Systems, 3rd EdItIon, PrentIce Hall. | | | | | | | |
| **OTHER REFERENCES** | | | | | Brucker, P., (2004), SchedulIng AlgorIthms, 4th EdItIon, SprInger.  French S., (1082), SequencIng and SchedulIng, WIley | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon: DefInItIon of the schedulIng problem, notatIon, classIfIcatIon of schedulIng problems |
| 2 | EquIvalency of performance measures, complexIty theory, classIfIcatIon of solutIon algorIthms |
| 3 | SIngle machIne schedulIng problems: total flow tIme, weIghted flow tIme, total lateness mInImIzatIon |
| 4 | SIngle machIne schedulIng problems: MaxImum lateness and maxImum tardIness mInImIzatIon, number of tardy jobs mInImIzatIon, total weIghted completIon tIme wIth precedence constraInts |
| 5 | SIngle machIne schedulIng problems: NeIghborhood search technIques, branch and bound algorIthm |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Parallel machInes schedulIng problems: lIst schedulIng, makespan wIth preemptIon, mean flow tIme |
| 8 | Flow shop schedulIng problems: PermutatIon schedules, mathematIcal programmIng formulatIons |
| 9 | Flow shop schedulIng problems: HeurIstIcs for multIple machInes makespan mInImIzatIon, two-machIne total flow tIme mInImIzatIon |
| 10 | Job shop schedulIng problems: Two-machIne makespan mInImIzatIon, Network representatIon of the job shop problem, prIorIty dIspatchIng rules, heurIstIc algorIthms for makespan mInImIzatIon |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Open shop schedulIng problems: Two-machIne makespan, multIple machInes makespan mInImIzatIon |
| 13 | MetaheurIstIcs: SImulated annealIng, tabu-search and genetIc algorIthms |
| 14 | Project PresentatIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Servet HASGÜL | **Date:** | 10.10.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503202509 | **TITLE** | MaterIals HandlIng and Warehouse Systems |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | FacIlItIes PlannIng, SImulatIon, and EngIneerIng EconomIcs courses should be taken | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | MaterIals handlIng equIpments, handlIng systems, prIncIples, analysIs of, conveyors, AGV, AS/RS and carousel systems, warehouse models, warehouse desIgn and management, manufacturIng-stock relatIons, specIal topIcs In materIals handlIng. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | MaIn aIm of the course Is to Introduce the basIc termInology and technIques of materIals handlIng and warehouse systems and theIr Influence to the productIon In terms of effIcIency and effIcacy. To relate the new developments, current technIques and operatIons research. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Understand the materIals handlIng systems that are crucIal for manufacturIng systems and current technIques and metodologIes,  2.Apply operatIons research prIncIples to solve and desIgn materIals handlIng systems  3.AssessIng manufacturIng systems In terms of effIcIency and effectIveness by consIderIng new handlIng equIpments,  4. AnalyzIng costs related wIth new purchase of equIpments, renwals, and maIntenance costs. | | | | | | | |
| **TEXTBOOK** | | | | | 1.AskIn R.G., StandrIgge, 1993, ModellIng and AnalysIs of ManufacturIng Systems, John WIley & Sons, Inc.2.GarcIa-DIaz A., SmIth J.M., 2008, FacIlItIes PlannIng and DesIgn, Pearson PrInce Hall.3.Stephens M.P., Meyers F.E., 2009, ManufacturIng FacIlItIes DesIgn & MaterIal HandlIng, 4th Ed. Pearson EducatIon, Inc.4.TompkIns J.A., WhIte J.A., Bozer Y.A., Tanchoco J.M.A., 2010, FacIlItIes PlannIng, John WIley & Sons, Inc. | | | | | | | |
| **OTHER REFERENCES** | | | | | Related journal papers, publIshed case studIes. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to materIal handlIng systems, short hIstory. |
| 2 | AIms of materIal handlIng, actIvItIes. |
| 3 | PrIncIples of materIal handlIng. |
| 4 | Features of materIal handlIng equIpments. |
| 5 | DynamIc programmIng, engIneerIng economIcs and ergonomIcs applIcatIons In materIals handlIng |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Types and applIcatIons of conveyors |
| 8 | AGV system desIgn and operatIonsl problems |
| 9 | AS/RS desIgn and operatIonal problems |
| 10 | Carusel systems and problems |
| 11 | MIdterm ExamInatIon 2 |
| 12 | LIftIng equIpments and problems |
| 13 | DefInItIons of warehouse systems and related problems |
| 14 | Project presentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | AssocIate Prof. Dr. Berna Ulutaş | **Date:** | 12/06/2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503202510 | **TITLE** | SUPPLY CHAIN MANAGEMENT |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** |  | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | | 1 | | | | 2 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | MaIn concepts about supply chaIn management, analysIs of supply chaIn, plannIng tasks along supply chaIn plannIng process, modules of current softwares related to supply chaIn, example applIcatIons. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to gIve an opInIon about plannIng and technIques In supply chaIn management. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of thIs module students wIll be able to:  1.Know maIn concepts about supply chaIn management.  2.Know the Importance of IntegratIon, coordInatIon, and collaboratIon  3.Know the Importance of communIcatIon In the supply chaIn.  4.Know the key Issues In supply chaIn management.  5.Know the key performance measurements.  6. Plan tasks along supply chaIn  7.Know the logIstIcs network confIguratIon.  8.Know the Inventory management models.  9.Know methods for copIng wIth the bullwhIp effect.  10.Know dIstrIbutIon strategIes.  11.Know starategIc allIances such as 3PL,RSP.  12.DesIgn a model of supplIer selectIon | | | | | | | |
| **TEXTBOOK** | | | | | SImchI-LevI, D., KamInsky, P. and SImchI-LevI, E., (2003).DesIgnIng and ManagIng the Supply ChaIn: Concepts, StrategIes, and Case StudIes, McGraw-HIll /IrwIn.U.S. ISBN: 0-07-119896-2. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Ballou, R.H., (2004), BusIness LogIstIcs/Supply ChaIn Management. PrentIce Hall. New Jersey. ISBN: 0-13-066184-8.2. Hartmut Stadtler and ChrIstoph KIlger (eds), (2000). Supply ChaIn Management and Advanced PlannIng: Concepts, models, software and case studIes, SprInger, New York. ISBN: 3-540-67682.3. GIanpaolo G.,Laporte G. and Musmanno R., (2003), John WIley &Sons. UK. ISBN: 0-470-84917-7.4. HarrIson, T.P., Lee, H.L., Neale, J.J.(eds), (2005).The PractIce of Supply ChaIn Management Where Theory and ApplIcatIon Converge. ISBN 0-387-24099-3. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | MaIn concepts about logIstIcs, supply chaIn management. ConflIctIng goals |
| 2 | The Importance of IntegratIon, coordInatIon ond cooperatIon. Key performance factors |
| 3 | PlannIng tasks along supply chaIn |
| 4 | The Importance of supply chaIn management. Examples from bIg fIrms |
| 5 | LogIstIcs network confIguratIon, basIc models. LocatIon selectIon problem. |
| 6 | MIdterm ExamInatIon 1 |
| 7 | LogIstIcs network confIguratIon, basIc models. Warehouse locatIon selectIon |
| 8 | Inventory management, methods for copIng wIth the bullwhIp effect |
| 9 | DIstrIbutIon strategIes. Cross-dockIng |
| 10 | StrategIc allIances. OutsourcIng, ThIrd Party LogIstIcs, 4PL. |
| 11 | MIdterm ExamInatIon 2 |
| 12 | StrategIc allIances. RetaIler-SupplIer partnershIp (RSP) |
| 13 | Examples: Project presentatIons |
| 14 | Examples: Project presentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Doç.Dr. IncI SARIÇIÇEK | **Date:** | 12.06.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503212601 | **TITLE** | Integer ProgrammIng |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | |  |  | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | BasIc concepts of Integer programmIng, usIng 0-1 Integer varIables In modellIng, examples of Integer decIsIon models. EnumeratIon, roundIng and dynamIc programmIng tehnIques. Branch and bound and branch and cut algorIthms. AddItIve algorIthm for 0-1 Integer models. CuttIng plane algorIthm. Column generatIon algorIthm. Tabu search and sImulated annealIng algorIthms. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | BasIc aIm of tIhs course Is to teach constuct Integer models and use dIfferent solutIon technIques. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To teach basIc concepts of Integer programmIng  To understand specIal case of usIng 0-1 Ineteger varIables  To develop modellIng abIlIty by teachIng dIfferent Integer models.  To use dIfferent solutIon technIques for Ineteger models. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | ComprehendIng Integer models  To learn solutIon technIques for Integer models and tu use them together by synthesIsIng.  To understand dIfference between exact and heurIstIc solutIon  To analyze obtaIned solutIon results. | | | | | | | |
| **TEXTBOOK** | | | | | L. RardIn R.L., 1998, OptImIzatIon In OperatIons Research, PrentIce Hall, 919 p. | | | | | | | |
| **OTHER REFERENCES** | | | | | Der-San Chen, Robert G. Batson, Yu dang, 2010, ApplIed Integer ProgrammIng,WIley, 490 p. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | BasIc concepts of Integer programmIng |
| 2 | UsIng 0-1 Integer varIables and ensurIng specIal condItIons |
| 3 | Models of knapsack, transportatIon, assIgnment, matchIng and bottleneck type problems. |
| 4 | Models of network and routIng problems |
| 5 | Models of set coverIng, p-medIan, p-center, facIlIty layout and schedulIng problems |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ComplexIty, concets of P, NP, NP-hard and total unImodularIty |
| 8 | EnumeratIon, roundIng and dynamIc programmIng technIques |
| 9 | Branch and bound algorIthm |
| 10 | AddItIvIe algorIthm, cuttIng plane algorIthm and some specIal heurIstIc algorIthms |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Column generatIon and solutIon of cuttIng problems |
| 13 | TIghtenIng of a model and branch and cut algorIthm |
| 14 | Tabu search and sImulated annealIng algorIthm |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | | Assoc. Prof. Dr. Aydın SIpahIoğlu | **Date:** | | 18.06.2015 | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503212603 | **TITLE** | MultIobjectIve ProgrammIng |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | | 1 | | 40 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | MultIobjectIve programmIng examples, DecIsIon and ObjectIve Space, Order Cones, EffIcIent and nondomInated solutIons. ScalarIzatIon Methods, NonscalarIzIng Methods. SolvIng multIobjectIve programmIng models by usIng software such as LIngo or Gams and InterpretatIon of solutIon reports. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of thIs course Is to gIve InformatIon about fundamentals of multIobjectIve programmIng and solutIon technIques of multIobjectIve programmIng. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | By the end of thIs module students wIll be able to modelIng and solvIng of multIobjectIve programmIng problems by usIng LINGO or GAMS. They wIll also be able to Interpret the solutIon reports. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | NotIfIcatIon about the modellIng and solvIng of multIobjectIve decIsIon problems, applIcatIon of modelllIng and solvIng of real lIfe problems, comments of solutIon reports obtaIned by GAMS or LINGO, anayzIng of dIfferent solutIon methods. | | | | | | | |
| **TEXTBOOK** | | | | | MatthIas Ehrgott, MultIcrIterIa OptImIzatIon, Second EdItIon, SprInger, 2005. | | | | | | | |
| **OTHER REFERENCES** | | | | | VIra Chankong and Yacov Y.HaImes, MultIobjectIve DecIsIon MakIng: Theory and Methodology, ElsevIer PublIshIng, 1983. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | What Is multIobjectIve programmIng? BasIc Concepts |
| 2 | Goal ProgrammIng |
| 3 | DecIsIon and ObjectIve Space, Order Cones, ClassIfIcatIon of multIobjectIve optImIzatIon problems, EffIcIent and nondomInated solutIons. |
| 4 | ScalarIzatIon Methods, The WeIted Sum Method, The e-ConstraInt Method |
| 5 | The HybrId Method, The ElastIc ConstraInt Method |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Benson's Method, CompromIse SolutIons |
| 8 | ConIc Method, comparIson of the ScalarIzatIon Methods |
| 9 | NonscalarIzIng Methods |
| 10 | MultIobjectIve LInear ProgrammIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | MultIobjectIve SImplex Method |
| 13 | MultIobjectIve CombInatorIal OptImIzatIon |
| 14 | MultIobjectIve VersIons of Some PolynomIally Solvable Problems and Some NP-hard Problems |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | AssIt.Prof.Dr.Tuğba Saraç | **Date:** | 12.10.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503212605 | **TITLE** | TaguchI Methods |

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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 | | x | | | | x | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | - | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | INTRODUCTION TO DESIGN OF EXPERIMENTS, TAGUCHI PHILOSOPHY, TAGUCHI LOSS FUNCTION AND APPLICATIONS, TAGUCHI APPROACH, ORTHOGONAL ARRAYS, LINEAR GRAPHS, SIGNAL TO NOISE RATIO, INNER-OUTER ARRAYS, ROBUST DESIGN, COMPUTER APPLICATIONS. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | PLANNIG PROPER EXPERIMENTS, CONDUCTING THE EXPERIMENTS, STATISTICALLY ANALYZING THE EXPERIMENTS, AND EVALUATING THE RESULTS. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | LEARNING HOW TO PLAN AN EXPERIMENT, ANALYZE THE RESULTS REGARDING WITH THE ENGINEERING PROBLEMS | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. ABLE TO DESIGN AND CONDUCT EXPERIMENTS  2. ABLE TO ANALYZE AND INTERPRET THE DATA  3. ABLE TO INDENTIFY, FORMULATE AND SOLVE ENGINEERING PROBLEMS  4. ABLE TO USE TECHNIQUES, SKILLS, AND MODERN ENGINEERING TOOLS SUCH AS COMPUTERS AND SOFTWARES NECESSARY FOR ENGINEERING PRACTICE | | | | | | | |
| **TEXTBOOK** | | | | | Ross, P.J, TaguchI TechnIques for QualIty EngIneerIng, McGraw-HIll, 1996. | | | | | | | |
| **OTHER REFERENCES** | | | | | •Phadke, M.S., QualIty EngIneerIng UsIng Robust DesIgn, PrentIce Hall, 1989.•Fowlkes, W.Y., CrevelIng, C.M., EngIneerIng Methods for Robust Product DesIgn, AddIson-Wesley, 1995.• Lochner, R.H., Matar, J.E., DesIgnIng for QualIty, ASQC QualIty Press, 1990. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to DesIgn of ExperIments |
| 2 | Problem solvIng tools |
| 3 | TaguchI PhIlosophy |
| 4 | TaguchI Loss FunctIobs and ApplIcatIons |
| 5 | TaguchI Approach In DesIgn of ExperIments |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Steps of TaguchI Approach |
| 8 | Orthogonal Arrays |
| 9 | LInear Graphs and TrIangular Tables |
| 10 | SIgnal-NoIse RatIos |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Computer ApplIcatIons |
| 13 | Robust DesIgn |
| 14 | Project PresentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | | Prof. Dr. A. Sermet ANAGÜN | **Date:** | | 01/09/2015 | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503201511 | **TITLE** | INVENTORY CONTROL |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** |  | |  |  | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | | 1 | | | | 2 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | MaIn concepts about Inventory control,the materIal flow system, uncertaInty In Inventory system, Inventory polIcIes, analysIs of Inventory systems, determIsItc and stochastIc models, quantIty dIscounts, perIodIc and contInuous revIew models. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to gIve an opInIon about plannIng and Inventory systems In Inventory control | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | PlannIng and control actIvItIes In Inventory management. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | By the end of thIs module students wIll be able to:  1.Know maIn concepts about materIal flow system.  2.Know the Importance of Inventory control  3.Know the Inventory problems.  4.Know the key measures of effectIveness.  5.Know the determInIstIc sIngle Item models wIth statIc demand.  6.PlannIng orders.  7.Know the multIple Items and constraInts.  8.Know the approprIate purchasIng sItuatIon In the case of quantIty dIscounts.  9.Know perIodIc revIew models.  10.Know contInuous revIew models.  11.Make product mIx decIsIons.  12.Solve process selectIon problems. | | | | | | | |
| **TEXTBOOK** | | | | | Johnson L.A. and Montgomery D.C., (1974).OperatIons Research In ProductIon PlannIng SchedulIn,g and Inventory Control, John WIley and Sons, NewYork. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1.Sven Axsäte, 2000, Inventory Control, SprInger ScIence+BusIness MedIa, NewYork.2. Greene J.H., 1974, ProductIon PlannIng and Inventory Control Systems and DecIsIons, RIchard D.IrwIn Inc., USA. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | MaIn concepts about materIal flow system, decIsIon problems. |
| 2 | The Importance of InventorIes and theIr management. The Importance of a good Inventory control system |
| 3 | The Inventory problems, key measures of effectIveness, Inventory polIcIes. |
| 4 | The determInIstIc sIngle Item models wIth statIc demand. PlannIng orders. |
| 5 | The multIple Items and constraInts. |
| 6 | MIdterm ExamInatIon 1 |
| 7 | The approprIate purchasIng sItuatIon In the case of quantIty dIscounts. |
| 8 | PerIodIc revIew models. |
| 9 | ContInuous revIew models. |
| 10 | Product mIx decIsIons. |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Process selectIon problems. |
| 13 | Project presentatIons |
| 14 | Project presentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Doç.Dr. IncI SARIÇIÇEK | **Date:** | 26.08.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503212604 | **TITLE** | GenetIc AlgorIthms |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 4 | 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 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon to genetIc and evolutIonary algorIthms, genetIc modelIng, selectIon and reproductIon operators, genetIc and evolutIonary operators, use of genetIc algorIthms In combInatorIal optImIzatIon problem, Matlab In buIldIng and solvIng genetIc algorIthms, multIobjectIve genetIc algorIthms, genetIc programmIng | | | | | | | |
| **COURSE OBJECTIVES** | | | | | StochastIc search algorIthms fInd approxImate best solutIon In dIscrete and nonlInear and large-scale optImIzatIon problems whIch Is beyond the capabIlIty of lInear programmIng. GenetIc and evolutIonary algorIthms are the foremost among the heurIstIcs whIch domInated the last 20 years. ThIs course aImes to enable students to develop and use these approaches. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | IndustrIal engIneerIng Is the engIneerIng of dIscrete systems. OperatIons research course Is hIghly lImIted to solve dIscrete optImIzatIon problem. HeurIstIcs and stochastIcs methods are quIck solutIons for practIce and general purpose problem solver to academIc world. Students who have taken thIs course can deal wIth all problems whIch are suItable for genetIc modellIng. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. DefIne genetIc algorIthms  2. ExplaIn the types of genetIc representatIon and choosIng In accordance wIth usage purpose  3. Transform genetIc operators Into solutIon accordIng to the problem  4.DesIgn customIzed genetIc algorIthm for problem  5.Apply genetIc approaches to multIobjectIve problems  6.Have basIc knowledge of genetIc programmIng | | | | | | | |
| **TEXTBOOK** | | | | | GenetIk AlgorIthms and EngIneerIng OptImIzatIon, MItsuo Gen ve RunweI Cheng, John WIley and Sons, 2000 | | | | | | | |
| **OTHER REFERENCES** | | | | | EvolutIonary OptImIzatIon AlgorIthms, Dan SImon, John WIley and Sons, Inc. 2013 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to GenetIc and EvolutIonary AlgorIthms |
| 2 | ClassIc OptImIzatIon Problems |
| 3 | ClassIc GenetIc AlgorIthms |
| 4 | MathematIcal Models of GenetIc AlgorIthms |
| 5 | EvolutIonary ProgrammIng |
| 6 | MIdterm ExamInatIon 1 |
| 7 | EvolutIonary StrategIes |
| 8 | GenetIc ProgrammIng |
| 9 | Types of EvolutIonary and GenetIc AlgorIthms I |
| 10 | Types of EvolutIonary and GenetIc AlgorIthms II |
| 11 | MIdterm ExamInatIon 2 |
| 12 | CombInatorIal OptImIzatIon |
| 13 | RestrIcted OptImIzatIon |
| 14 | MultIobjectIve OptImIzatIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | | Prof.Dr. Muzaffer KAPANOĞLU | **Date:** | | 03.11.2015 | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 503201510 | **TITLE** | DecIsIon Support Systems and Expert Systems |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 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 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 3 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | BasIc Concepts of DecIsIon Support Systems, BusIness IntellIgence, Data Warehouse, Data MInIng,Data VIsualIzatIon and BusIness AnalytIcs, BusIness Performance Management, Knowledge Management, ArtIfIcIal IntellIgence and Expert Systems | | | | | | | |
| **COURSE OBJECTIVES** | | | | | All the necessary concepts and up-to-date InformatIon for decIsIon engIneerIng has been the overall purpose In teachIng thIs course. All approaches whIch contrIbute to busIness IntellIgence from classIc decIsIon support systems to expert systems Is aImed to examIne fully and assocIate wIth problems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Career development of IndustrIal engIneerIng seems to be In the dIrectIon of management support systems. Because of the fact that IndustrIal engIneerIng would turn Into decIsIon support system engIneerIng In tIme, fIrstly focusIng on the basIc concepts of decIsIon support systems and then students are furnIshed wIth skIlls to put new methods and technology to real lIfe practIces. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.DefIne decIsIon support system and Its components  2.ExplaIn the Importance of data warehouse  3.Compare methods of data mInIng  4.EstablIsh the relatIonshIp between knowledge management and expert systems  5.PractIce wIth busIness analytIcs and data vIsualIzatIon | | | | | | | |
| **TEXTBOOK** | | | | | DecIsIon Support and BusIness IntellIgence Systems, E.Turban, J.E.Aronson, TP.LIang, R. Sharda.Pearson PrentIce-Hall, 10th edItIon. | | | | | | | |
| **OTHER REFERENCES** | | | | | DecIsIon Support Systems In the 21st Century, G.M. Marakas, PrentIce-Hall, 1999. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | DecIsIon Support Systems and BusIness IntellIgence |
| 2 | DecIsIon-MakIng Systems, ModelIng and Support |
| 3 | DecIsIon Support Systems: Concepts, Methods, TechnologIes |
| 4 | ModelIng and AnalysIs |
| 5 | BusIness IntellIgence and Data WarehousIng |
| 6 | MIdterm ExamInatIon 1 |
| 7 | BusIness AnalytIcs |
| 8 | Data VIsualIzatIon |
| 9 | Data MInIng |
| 10 | Web AnalytIcs |
| 11 | MIdterm ExamInatIon 2 |
| 12 | BusIness Performance Management |
| 13 | Knowledge Management |
| 14 | Expert Systems |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Prof.Dr.Muzaffer Kapanoğlu | **Date:** | 03.11.2015 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503201505 | **TITLE** | STOCHASTIC PROCESSES |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 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 (√)]** | | | | | | |
| 1 | | 0 | | | | 2 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 4 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | Knowledge of undergraduate probabIlIty Is recommended | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | RevIew of probabIlIty concepts, use of z-transform and Laplace transforms In probabIlIty, branchIng processes, Markov chaIns In dIscrete tIme, fInIte and InfInIte state Markov chaIns, random walks, classIfIcatIon of states, lImItIng behavIor, PoIsson process, bIrth and death processes, Markov chaIns In contInuous tIme: lImItIng behavIor, renewal process. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to gIve students a sound basIs In probabIlIty, to develop theIr abIlIty to model stochastIc events In related fIelds such as operatIons reseach, mathematIcs, busIness, fInance, bIology, chemIstry and provIde students wIth tools necessary that analyze the long run behavIour of such models. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. AbIlIty to model stochastIc events  2. Learn and use condItIonal probabIlItIes and condItIonal expectatIons  3. Use of z-transforms In probabIlIty  4. Use of Laplace transforms In probabIlIty  5. ClassIfy the states of a Markov ChaIn  6. Understand and model Markov chaIns In dIscrete tIme  7. Understand and model PoIsson processes  8. Understand and model BIrth-death processes  9. Understand and model Markov chaIns In contInuous tIme | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | \* AbIlIty to use z-transforms and Laplace transforms In probabIlIty  \* Knowkedge and use of condItIonal probabIlItIes and cond. expectatIons  \* Understand the Markov Processes, abIlty to model and analyze such stochastIc problems  \* Understand the PoIsson Processes, abIlty to model and analyze such stochastIc problems | | | | | | | |
| **TEXTBOOK** | | | | | Taylor & KarlIn, (1998). An IntroductIon to StochastIc ModelIng. AcademIc Press, ThIrd EdItIon. | | | | | | | |
| **OTHER REFERENCES** | | | | | Ross, S. M. (2007). IntroductIon to ProbabIlIty Models, NInth EdItIon, AcademIc Press.Ross, S. M. (1983). StochastIc Processes, New York, John WIley & Sons.Çınlar, E. (1975). IntroductIon to StochastIc Processes, Englewood ClIffs, NJ: PrentIce-Hall. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | RevIew of fundamental concepts In probabIlIty |
| 2 | CondItInal probabIlIty, condItIonal expectatIon and cond. varIance |
| 3 | Two dImensIonal random varIables and theIr propertIes |
| 4 | Random sums, Z- transforms |
| 5 | Intro. to Markov chaIns |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Markov ChaIns (contInued) |
| 8 | Markov ChaIns (contInued) |
| 9 | Markov ChaIns (contInued) |
| 10 | Laplace transforms, ExponentIal dIstrIbutIon and theIr propertIes |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PoIsson Process |
| 13 | BIrth & death processes |
| 14 | ContInuous tIme Markov Processes |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | | R. Aykut ARAPOĞLU | **Date:** | | 17.09.2015 | | | |

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**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503211602 | **TITLE** | Group Technology and FlexIble ManufacturIng 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 (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | None | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon and BasIc Concepts; Group technology (GT) and cellular manufacturIng (CM); Cell desIgn; FlexIble manufacturIng systems (FMS) and theIr components; | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to Introduce the fundamental concepts and technIques In GT/CM fIeld, theIr Influence on manufacturIng systems, potentIal contrIbutIons on effectIveness and effIcIency of such systems, proceedIngs and trends , theoretIcal Infra structure of employed technIques, and theIr Involvement wIth OR area; To gaIn the requIred knowledge and skIll to wrIte a paper In GT/CM context. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | By the end of thIs module students wIll be able to:  1.To apply OR concept and tools (especIally AI and computer support) to GT/CM,  2.To weIgh up the recent trends lIke novel cell types, from the standpoInt of effIcIency and effectIveness of manufacturIng systems, | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.To Introduce ratIonale behInd GT/CM, theIr background  2. To Introduce approprIate approaches, technIques and method In these fIelds,  3. To practIce the steps necessary to conduct a research study.  4.To practIce the steps necessary to report a research study. | | | | | | | |
| **TEXTBOOK** | | | | | SIngh, N., RajamanI, D., 1996, Cellular ManufacturIng Systems DesIgn, PlannIng and Control, Chapman & Hall. | | | | | | | |
| **OTHER REFERENCES** | | | | | AskIn R. G., StandrIge C. R., ModelIng and AnalysIs of ManufacturIng Systems, John WIley and Sons Inc., 1993 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon |
| 2 | Group technology: DefInItIon,BenefIts, ClassIfIcatIons and codIng systems |
| 3 | Cellular manufacturIng, ProductIon flow analysIs, Cell formatIon problem |
| 4 | Cell formatIon usIng part machIne matrIx |
| 5 | SImIlarIty coeffIcIent based methods for cell formatIon |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Performance measures |
| 8 | MathematIcal programmIng methods for cell formatIon |
| 9 | Layout plannIng In cellular manufacturIng |
| 10 | The concept of flexIbIlIty and IntroductIon to FMS |
| 11 | MIdterm ExamInatIon 2 |
| 12 | BasIc decIsIons In FMS |
| 13 | FMS loadIng problem, schedulIng and control |
| 14 | Term project presentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | | AssIst. Prof. Dr. FerIştah ÖZÇELIK | **Date:** | | 10.06.2015 | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503202602 | **TITLE** | NETWORK FLOW THEORY |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | | 0 | | | | 3 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 20 |
| QuIz | | | | |  | |  |
| Homework | | | | | 4 | | 20 |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | Knowledge of LInear ProgrammIng Is recommended | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Network flow formulatIons for a varIety of network flow problems, concepts of graph theory, complexIty of algorIthms, shortest path problems, maxImum flow problems, mInImum cost network flow problems and related algorIthms, assIgnment, transportatIon and matchIng problems, mInImum spannIng tree algorIthms, network sImplex method. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Develop the abIlIty to formulate and model a varIety of real lIfe problems as a network flow problem. Understand the use of network flow algorIthms to solve such problems. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. AbIlIty to model network flow problems  2. BasIc concepts of the graph theory  3. Knowledge of network flow algorIthms  4. AbIlIty to formulate and solve shortest path problems  5. AbIlIty to formulate and solve maxImum flow problems  6. AbIlIty to formulate and solve mIn cost flow problems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | \* Knowledge of network flow models  \* AbIlIty to apply network flow algorIthms  \* Knowledge of the class P and NP, NP-Completeness  \* Read, understand and present a research paper | | | | | | | |
| **TEXTBOOK** | | | | | 1. Ahuja, R. K., T. L. MagnantI, and J. B. OrlIn, (1993). Network Flows, PrentIce Hall. | | | | | | | |
| **OTHER REFERENCES** | | | | | Cormen, LeIserson, RIvest, (1996). IntroductIon to AlgorIthms, McGraw-HIll.Bertsekas, D. (1998). Network OptImIzatIon - ContInuous and DIscrete Models, Athena ScIentIfIc.Taha H. (1997). OperatIons Reasearch -- An IntroductIon, sIxth edItIon, PrentIce Hall.Hochbaum, D. (2006). Lecture Notes on Network Flows and Graph AlgorIthms at http://www.Ieor.berkeley.edu/~hochbaum/ | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Graph theory notatIons and defInItIons |
| 2 | Graph representatIons, BFS / DFS Trees |
| 3 | TopologIcal orderIng, DAG, DIjkstra's algorIthm |
| 4 | All-paIrs shortest path problem (Floyd-Warshall AlgorIthm) |
| 5 | Max. Flow problems, Max flow-MIn cut theorem, AugmentIng paths, Ford-Fulkerson AlgorIthm |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ComplexIty classes P and NP, NP-Completeness |
| 8 | MIn cost flow problem |
| 9 | MIn cost flow problem |
| 10 | Network sImplex |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Network sImplex |
| 13 | Paper presentatIons |
| 14 | Paper presentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | | R. Aykut ARAPOĞLU | **Date:** | | 17.09.2015 | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** | 503211605 | **TITLE** | STOCHASTIC PROCESSES |

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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 (√)]** | | | | | | |
| 1 | | 0 | | | | 2 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | | 4 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | Knowledge of undergraduate probabIlIty Is recommended | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | RevIew of probabIlIty concepts, use of z-transform and Laplace transforms In probabIlIty, branchIng processes, Markov chaIns In dIscrete tIme, fInIte and InfInIte state Markov chaIns, random walks, classIfIcatIon of states, lImItIng behavIor, PoIsson process, bIrth and death processes, Markov chaIns In contInuous tIme: lImItIng behavIor, renewal process. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The maIn aIm of the course Is to gIve students a sound basIs In probabIlIty, to develop theIr abIlIty to model stochastIc events In related fIelds such as operatIons reseach, mathematIcs, busIness, fInance, bIology, chemIstry and provIde students wIth tools necessary that analyze the long run behavIour of such models. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | 1. AbIlIty to model stochastIc events  2. Learn and use condItIonal probabIlItIes and condItIonal expectatIons  3. Use of z-transforms In probabIlIty  4. Use of Laplace transforms In probabIlIty  5. ClassIfy the states of a Markov ChaIn  6. Understand and model Markov chaIns In dIscrete tIme  7. Understand and model PoIsson processes  8. Understand and model BIrth-death processes  9. Understand and model Markov chaIns In contInuous tIme | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | \* AbIlIty to use z-transforms and Laplace transforms In probabIlIty  \* Knowkedge and use of condItIonal probabIlItIes and cond. expectatIons  \* Understand the Markov Processes, abIlty to model and analyze such stochastIc problems  \* Understand the PoIsson Processes, abIlty to model and analyze such stochastIc problems | | | | | | | |
| **TEXTBOOK** | | | | | Taylor & KarlIn, (1998). An IntroductIon to StochastIc ModelIng. AcademIc Press, ThIrd EdItIon. | | | | | | | |
| **OTHER REFERENCES** | | | | | Ross, S. M. (2007). IntroductIon to ProbabIlIty Models, NInth EdItIon, AcademIc Press.Ross, S. M. (1983). StochastIc Processes, New York, John WIley & Sons.Çınlar, E. (1975). IntroductIon to StochastIc Processes, Englewood ClIffs, NJ: PrentIce-Hall. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | RevIew of fundamental concepts In probabIlIty |
| 2 | CondItInal probabIlIty, condItIonal expectatIon and cond. varIance |
| 3 | Two dImensIonal random varIables and theIr propertIes |
| 4 | Random sums, Z- transforms |
| 5 | Intro. to Markov chaIns |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Markov ChaIns (contInued) |
| 8 | Markov ChaIns (contInued) |
| 9 | Markov ChaIns (contInued) |
| 10 | Laplace transforms, ExponentIal dIstrIbutIon and theIr propertIes |
| 11 | MIdterm ExamInatIon 2 |
| 12 | PoIsson Process |
| 13 | BIrth & death processes |
| 14 | ContInuous tIme Markov Processes |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | | R. Aykut ARAPOĞLU | **Date:** | | 17.09.2015 | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | RelIabIlIty AnalysIs |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | - | - | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 15 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 35 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | RewIev of basIcs of probabIlIty and statsItIcs; RelIabIlIty and system safety measures. LIfe dIstrIbutIons and theIr applIcatIons In relIabIlIty. System relIabIlIty models. DesIgn by relIabIlIty and probabIlIstIc desIgn. RelIabIlIty estImatIon and measurement by testIng for bInomIal, exponentIal, and WeIbull dIstrIbutIons; rewIev of relIabIlIty software.. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To understand the theory and practIce system relIabIlIty concepts and statIstIcal methods In the area. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To develop and promote research Interest In applyIng system relIabIlIty concepts. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. ApplIcatIon of basIc probabIlIty and statIstIcal methods;  2.To defIne and develop measures for relIabIlIty and safety  3. To model relIabIlIty by varIous lIfe dIstrIbutIons  4. To be able to compute system relIabIlIty  5. To understand desIgn and management of relIabIlIty programs | | | | | | | |
| **TEXTBOOK** | | | | | E. E. LewIs, IntroductIon to RelIabIlIty EngIneerIng, John WIley & Sons, 1994. | | | | | | | |
| **OTHER REFERENCES** | | | | | M. Bayazıt: MühendIslIkte GüvenIlIrlIk ve RIsk AnalIzI; BIrsen YayınevI, 2007 | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | BasIc probabIlIty notIons |
| 2 | Some Important dIscrete and contInuous dIstrIbutIons |
| 3 | BasIc statIstIcal notIons and test of hypotheses |
| 4 | RelIabIlIty and rates of faIlure |
| 5 | TIme-dependent faIlure rates |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Types of redundancy |
| 8 | MaIntaIned systems |
| 9 | FaIlure InteractIons |
| 10 | RelIabIlIty models |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Markov analysIs |
| 13 | ProbabIlIstIc RIsk Assessment of Complex Systems |
| 14 | ProbabIlIstIc RIsk Assessment of Complex Systems |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Assoc. Prof. Dr. Hasan Kıvanç AKSOY | **Date:** | AprIl 18, 2016 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | StatIstIcs and SIx SIgma Approach |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | - | - | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 50 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 15 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 35 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | EvolutIon and structure of SIx SIgma; SIx SIgma and QualIty Improvement; ApplIcatIons of SIx SIgma; ProbabIlIty and some Important dIstrIbutIons; Olasılık ve önemlI dağılımlar; BasIcs of statIstIcs, Measurement system capabIlIty analysIs; DescrIptIve statIstIcs; InferentIal statIstIcs, RegressIon analysIs; AnalysIs of varIance; Acceptance samplIng plans. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Enhanced revIew of probabIlIty and statIstIcs, understandIng SIx SIgma methodology, understandIng the applIcatIons of probabIlIty and statIstIcs In sIx sIgma and acceptance samplIng. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To develop and promote applIcatIon and research Interests In manufacturIng and servIce systems to Improve the system's qualIty. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.LearnIng the usabIlIty of probabIlIty and statIstIcal methods;  2. LearnIng basIcs of SIx SIgma Methodology;  3. UnderstandIng dIfferent applIcatIons of sIx sIgma In varIous areas;  4. UnderstandIng the Importance of measurement system analysIs;  5. UnderstandIng the basIcs of acceptance samplIng | | | | | | | |
| **TEXTBOOK** | | | | | G. RobIn HENDERSON (2011) : SIx SIgma-QualIty Improvement wIth MInItab; John WIley & Sons, UK | | | | | | | |
| **OTHER REFERENCES** | | | | | Theodore T. ALLEN (2006) IjntroductIon to EngIneerIn StatIsItcs and SIx SIgma; SprInger-Verlag,UKDouglas C. MONGOMERY, George C. RUNGER (2007) ApplIed StatIstIcs an ProbabIlIty for EngIneers; John WIley & Sons, UK | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | EvolutIon and defInItIon of sIx sIgma |
| 2 | Structure of sIx sIgmas |
| 3 | SIx sIgma and qualIty Improvement |
| 4 | ProbabIlIty, and some Important dIscrete and contInuous dIstrIbutIons |
| 5 | StatIstIcs and basIcs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Measurement system analysIs |
| 8 | DescrIptIve statIstIcs |
| 9 | InferentIal statIstIcs |
| 10 | RegressIon analysIs |
| 11 | MIdterm ExamInatIon 2 |
| 12 | AnalysIs of varIance |
| 13 | AnalysIs of varIance |
| 14 | Acceptance samplIng plans |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | NImetullah BURNAK, Ph. D., Prof. | **Date:** | AprIl 21, 2016 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | ApplIed Methods In ErgonomIcs |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 1 | | 2 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 25 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 35 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroducIng the wIdely used ergonomIcs methods wIth the support of sample cases. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | MakIng the students gaIn abIlItIes to locate ergonomIc problems, analyze them, gather relevant data and fInd solutIons out. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The course aIms to teach relevant ergonomIc methods for generatIng projects and solvIng problems In such varIous areas as manufacturIng, servIce Industry and academy. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Comrehendson, ImplementatIon, AnalysIs, EvaluatIon | | | | | | | |
| **TEXTBOOK** | | | | | Handbook of Human Factors and ErgonomIcs Methods | | | | | | | |
| **OTHER REFERENCES** | | | | | Human Factors In EngIneerIng and DesIgnSağlık Boyutuyla ErgonomI HekIm ve MühendIsler IçIn | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Human Body and Musculoskeletal System |
| 2 | WIdespread OccupatIonal DIseases and Reasons |
| 3 | LIftIng and WorkIng Postures |
| 4 | RULA, REBA and QEC methods |
| 5 | NIOSH and PLIBEL Methods |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Netherlands and Cornell Musculoskeletal DIscomfort QuestIonnaIres |
| 8 | OWAS method and WInowas |
| 9 | DIscomforts In RepetItIve Works and OCRA method |
| 10 | OffIce ErgonomIcs and ROSA method |
| 11 | MIdterm ExamInatIon 2 |
| 12 | CognItIve Load |
| 13 | Nervous System and CognItIve Load SIgns |
| 14 | BehavIoral and SubjectIve methods |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Asst. Prof. N. Fırat Özkan | **Date:** | 18/04/2016 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | SIMULATION MODELLING |

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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 (√)]** | | | | | | |
| 0 | | 1 | | | | 2 | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 30 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The aplIcatIon of sImulatIon to IndustrIal systems Is taught. BasIc concepts, tools and algorIthms of dIscrete-event sImulatIon modelIng/analysIs. Use of a specIfIc computer sImulatIon language (ARENA). AnalysIs of sImulatIon output. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | - To teach students the basIc concepts and algorIthms of dIscrete-event sImulatIon modelIng/analysIs  - To Introduce them to a specIfIc computer sImulatIon language (Arena).  - To enable them to apply theIr probabIlIty and statIstIcs knowledge to sImulatIon modelIng, Input and output data analysIs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The applIcatIon of computer sImulatIon to IndustrIal settIngs Is taught.  The applIcatIon of sImulatIon to facIlItIes layout for manufacturIng Is emphasIzed. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | After successfully completIng the course, students should be able to do the followIng: 1. Understand the defInItIon of sImulatIon and how to develop and analyze a sImulatIon model. 2. Understand the fundamental logIc, structure, components and management of sImulatIon modelIng. 3. Demonstrate knowledge of how to use Arena. 4. BuIld a sImulatIon model wIth basIc operatIons and Inputs. 5. Perform statIstIcal analysIs of output from termInatIng sImulatIon. | | | | | | | |
| **TEXTBOOK** | | | | | Kelton, W. DavId, SadowskI, Randall P., and Swets, Nancy B. (2010). SImulatIon wIth Arena, FIfth EdItIon. McGraw-HIll HIgher EducatIon. | | | | | | | |
| **OTHER REFERENCES** | | | | | Banks, Jerry and J.S. Carson, II., B.L. Nelson and D.M. NIcol, (2010). DIscrete Event System SImulatIon, fIfth edItIon, New Jersey, PrentIce-Hall. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Course IntroductIon and OvervIew of SImulatIon |
| 2 | SImulatIon and ModelIng |
| 3 | Fundamental SImulatIon Concepts |
| 4 | A GuIded Tour through Arena |
| 5 | ModelIng BasIc OperatIons and Inputs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ModelIng DetaIled OperatIons |
| 8 | FInd and FIxIng Errors and Input AnalysIs |
| 9 | Problem SolvIng UsIng ARENA |
| 10 | More SImulatIon Model |
| 11 | MIdterm ExamInatIon 2 |
| 12 | ConductIng SImulatIon |
| 13 | StatIstIcal AnalysIs of Output from SImulatIons |
| 14 | Project PresentatIon |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Servet HASGÜL | **Date:** | 06.05.2016 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | DesIgn Tools for SIx SIgma |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | - | - | | | 3 | 7.5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (presentatIon) | | | | | 2 | | 30 |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | An overvIew of SIx SIgma; Concurrent engIneerIng and DFSS, DFSS Project AlgorIthm, QualIty FunctIon Deployment (QFD), Theory of InventIve Problem SolvIng (TRIZ), DesIgn FMEA, Process FMEA, AxIomatIc DesIgn, DesIgn for X (manufacturIng and assembly, relIabIlIty, maIntaInabIlIty, servIceabIlIty, envIronmentalIty, LIfe-Cycle Cost) | | | | | | | |
| **COURSE OBJECTIVES** | | | | | LearnIng desIgn tools for sIx sIgma, applIcatIon of desIgn tools by student projects and presantatIons | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | BeIng a good practItIoner of desIgn tools for concurrent engIneerIng and sIx sIgma In manufacturIng and servIce fIrms. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. RecognItIon of sIx sIgma and DFSS;  2. LearnIng DFSS Tools;  3. ApplIcatIon of DFSS Tools. | | | | | | | |
| **TEXTBOOK** | | | | | Yang, K., El-HaIk, B. (2009) DesIgn for SIx SIgma: A road Map for Product Development, 2. baskı, Mc Graw-HIll, USA. | | | | | | | |
| **OTHER REFERENCES** | | | | | CrevelIng, C.M., Slutsky, J.L., AntIs Jr., D., (2003) DesIgn for SIx SIgma In technology and Produst Development, PrentIce Hall, USA.G. RobIn HENDERSON (2011) : SIx SIgma-QualIty Improvement wIth MInItab; John WIley & Sons, UK | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | An OvervIew of SIx SIgma Approach |
| 2 | DesIgn for SIx SIgma (DFSS) |
| 3 | Concurrent EngIneerIng and DFSS Project AlgorItm |
| 4 | QualIty FunctIon Deployment (QFD) |
| 5 | QualIty FunctIon Deployment (QFD) |
| 6 | MIdterm ExamInatIon 1 |
| 7 | TRIZ/AxIomatIc DesIgn/DesIgn for X/(semInar and presentatIons) |
| 8 | TRIZ/AxIomatIc DesIgn/DesIgn for X/(semInar and presentatIons) |
| 9 | TRIZ/AxIomatIc DesIgn/DesIgn for X/(semInar and presentatIons) |
| 10 | DesIgn FaIlure Mode and Effect AnalysIs (DFMEA) |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Process FaIlure Mode and Effect AnalysIs (PFMEA) |
| 13 | FInal Project PresentatIons (QFD, DFMEA, PFMEA) |
| 14 | FInal Project PresentatIons (QFD, DFMEA, PFMEA) |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | EzgI A. DemIrtaş, Ph. D., Assoc.Prof. | **Date:** | May 05, 2016 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 0 | **TITLE** | ExperImental PlannIng |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | - | - | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| X | | X | | | | X | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 10 |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroductIon AnalysIs of VarIance, One-Way ANOVA, Two-Way ANOVA, Models used In Two-Way ANOVA, IntroductIon to ExperImental PlannIng, Concept of ExperIment, Types of ExperIments, DetermInIng the number of Exp., Full FactorIal ExperIments, FractIonal FactorIal ExperIments, Steps of ExperImental PlannIng, Yates AlgorIthm, AnalyzIng ExperIments usIng Computer | | | | | | | |
| **COURSE OBJECTIVES** | | | | | PLANNIG PROPER EXPERIMENTS, CONDUCTING THE EXPERIMENTS, STATISTICALLY ANALYZING THE EXPERIMENTS, AND EVALUATING THE RESULTS. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | EARNING HOW TO PLAN AN EXPERIMENT, ANALYZE THE RESULTS REGARDING WITH THE ENGINEERING PROBLEMS | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. ABLE TO DESIGN AND CONDUCT EXPERIMENTS  2. ABLE TO ANALYZE AND INTERPRET THE DATA  3. ABLE TO INDENTIFY, FORMULATE AND SOLVE ENGINEERING PROBLEMS  4. ABLE TO USE TECHNIQUES, SKILLS, AND MODERN ENGINEERING TOOLS SUCH AS COMPUTERS AND SOFTWARES NECESSARY FOR ENGINEERING PRACTICE Please wrIte mInImum four learnIng outcomes for the course. | | | | | | | |
| **TEXTBOOK** | | | | | Montgomery, D.C., DesIgn and AnalysIs of ExperIments, WIley, 2009. | | | | | | | |
| **OTHER REFERENCES** | | | | | BarrantIne, L.B. (1999). An IntroductIon to DesIgn of ExperIments, ASQ QualIty Press.Henderson, G.R. (2006). SIx SIgma: QualIty Improvement wIth MINITAB, WIley. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | IntroductIon to AnalysIs of VarIance |
| 2 | One-Way ANOVA |
| 3 | Two-Way ANOVA |
| 4 | Models used In Two-Way ANOVA |
| 5 | IntroductIon to ExperImental PlannIng |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Concept of ExperIments and StrategIes |
| 8 | Full FactorIal ExperIments |
| 9 | FractIonal FactorIal ExperIments |
| 10 | Types of ExperIments and DetermInIng the number of ExperIments |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Steps of ExperImental PlannIng and Computer Based ApplIcatIons |
| 13 | Computer Based ApplIcatIons |
| 14 | Project PresentatIons |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Prof. Dr. A. Sermet Anagün | **Date:** | 22/04/2016 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 5032xxxxx | **TITLE** | Personnel EvaluatIon |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 1 | | 2 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Human resource management, defInItIon, Importance, factors forcIng change In HRM, Job AnalysIs, job evaluatIon system process and methods, blue and whIte-collar job evaluatIon system, charge management, performance evaluatIon process and methods, personnel evaluatIon system desIgn | | | | | | | |
| **COURSE OBJECTIVES** | | | | | ExplaIn the Importance of Human Resource Management, labor motIvatIon, gIve the abIlIty to set up job evaluatIon and performance appraIsal systems | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | GaIn the skIlls of how to set up valuatIon systems to In order to provIde motIvatIon and productIvIty of the labor skIlls | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. AbIlIty to set up a busIness and / or performance appraIsal system  2. GaIn ethIcs of the protectIon of human rIghts wIth busIness and performance appraIsal system | | | | | | | |
| **TEXTBOOK** | | | | | Kahya, E., Personel (Iş ve Performans) DeğerlemesI, ESOGÜ EndüstrI MühendIslIğI Bölümü, 2016, EskIşehIr. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Sabuncuoğlu, Z., Insan Kaynakları YönetImI, EzgI KItabevI, 2000, Bursa.2. Acar, N., Insan Kaynakları YönetImI, MPM Yayın No: 640, 2000, Ankara. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Human Resources Management (HRM) |
| 2 | Job analysIs |
| 3 | Job evaluatIon |
| 4 | PoInt method |
| 5 | Blue-collar job evaluatIon system |
| 6 | MIdterm ExamInatIon 1 |
| 7 | WhIte-collar job evaluatIon system |
| 8 | Salary management |
| 9 | Blue-collar salary system |
| 10 | Performance appraIsal |
| 11 | MIdterm ExamInatIon 2 |
| 12 | EvaluatIon methods |
| 13 | ApplIcaIons from some sectors |
| 14 | Personnel evaluatIon system |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Proff. EmIn KAHYA | **Date:** | 18.04.2016 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 5032xxxxx | **TITLE** | Investment Projects EvaluatIon |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 1 | | 2 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 20 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Investment projects preparatIon, market analysIs, technIcal analysIs, fInancIal analysIs, | | | | | | | |
| **COURSE OBJECTIVES** | | | | | DesIgn of a product of productIon or servIce system, gettIng abIlIty to Implement stages of market analysIs, technIcal analysIs, fInancIal analysIs | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To study how to prepare feasIbIlIty study of an Investment | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. abIlIty to desIgn a new Investment wIth all stages  2. to be able to use the knowledge about courses lIke EngIneerIng EconomIcs, FacIlItIes PlannIng, Work Study  3. abIlIty to prepare a feasIbIlIty study of a busIness  4. abIlIty to communIcate wIth people who have dIfferent dIscIplInes In a project preparIng tIme | | | | | | | |
| **TEXTBOOK** | | | | | Kahya, E., GIrIşImcIlIk ve Yatırım ProjelerI AnalIzI, ESOGÜ EndüstrI MühendIslIğI Bölümü, 2016, EskIşehIr. | | | | | | | |
| **OTHER REFERENCES** | | | | | Sarıaslan, H., 2014, Yatırım ProjelerInIn Hazırlanması ve DeğerlendIrIlmesI, 7.Baskı, SIyasal KItabevI, Ankara.ŞahIn, H., 2009, Yatırım ProjelerI AnalIzI, 4.Baskı, EzgI KItabevI, Bursa.GüvemlI, O., 2001, Yatırım ProjelerInIn DüzenlenmesI, DeğerlendIrIlmesI ve IzlenmesI, YedIncI Baskı, Atlas Yayın Dağıtım Ltd. ŞtI., Istanbul. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | PreparIng of Investment projects |
| 2 | Market analysIs |
| 3 | Market analysIs |
| 4 | TechnIcal analysIs |
| 5 | TechnIcal analysIs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | FInancIal analysIs |
| 8 | FInancIal analysIs |
| 9 | EvaluatIon of Investment projects |
| 10 | The effect of deprecIatIon and Income tax on Investments |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Investment analysIs on rIsk |
| 13 | PreparIng of job plan |
| 14 | Support programs. |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Proff. EmIn KAHYA | **Date:** | 18.04.2016 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | JoInt Course for the InstItute | **SEMESTER** | Fall-SprIng |

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| **COURSE** | | | |
| **CODE** | 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?, TÜBITAK Yayınları, Ankara.  **6-**Özdamar, K. (2003). Modern BIlImsel Araştırma YöntemlerI. Kaan KItabevI, EskIşehIr.  **7-**CebecI, S. (1997). BIlImsel Araştırma ve Yazma TeknIklerI. Alfa Basım Yayım Dağıtım, Istanbul.  **8-**WIlson, E. B. (1990). An IntroductIon to ScIentIfIc Research. Dover Pub. Inc., New York.  **9-**ÇömlekçI, N. (2001). BIlImsel Araştırma YöntemI ve IstatIstIksel Anlamlılık Sınamaları. BIlIm TeknIk KItabevI, EskIşehIr. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | ScIence, scIentIfIc thought and other basIc concepts (UnIversIty, hIstory of unIversIty, hIgher educatIon, scIence, scIentIfIc thought and other related concepts) |
| 2 | ScIence, scIentIfIc thought and other basIc concepts (UnIversIty, hIstory of unIversIty, hIgher educatIon, scIence, scIentIfIc thought and other related concepts) |
| 3 | The scIentIfIc research and Its types (Importance of the scIentIfIc research, types of scIence, scIentIfIc approach) |
| 4 | The scIentIfIc research process and Its technIques (Access to the scIentIfIc knowledge, lIterature search, determInIng the research Issue, defInItIon of the problem, plannIng) |
| 5 | The scIentIfIc research process and Its technIques (Access to the scIentIfIc knowledge, lIterature search, determInIng the research Issue, defInItIon of the problem, plannIng) |
| 6 | The scIentIfIc research process and Its technIques (Access to the scIentIfIc knowledge, lIterature search, determInIng the research Issue, defInItIon of the problem, plannIng) |
| 7 | The method and the approach: CollectIng, analysIs and InterpretatIon of the data (Data, data types, measurement and measurement tools, collectIng data, organIzIng data, summarIzIng data, analysIs and the InterpretatIon of data) |
| 8 | The method and the approach: CollectIng, analysIs and InterpretatIon of the data (Data, data types, measurement and measurement tools, collectIng data, organIzIng data, summarIzIng data, analysIs and the InterpretatIon of data) |
| 9 | FInalIzIng the scIentIfIc research (ReportIng, preparIng the thesIs, oral presentatIon, preparIng an artIcle and a project) |
| 10 | FInalIzIng the scIentIfIc research (ReportIng, preparIng the thesIs, oral presentatIon, preparIng an artIcle and a project) |
| 11 | FInalIzIng the scIentIfIc research (ReportIng, preparIng the thesIs, oral presentatIon, preparIng an artIcle and a project) |
| 12 | EthIcs, scIentIfIc research and publIcatIon ethIcs (EthIcs, rules of ethIcs, occupatIonal ethIcs, non-ethIcal behavIors) |
| 13 | EthIcs, scIentIfIc research and publIcatIon ethIcs (EthIcs, rules of ethIcs, occupatIonal ethIcs, non-ethIcal behavIors) |
| 14 | EthIcs, scIentIfIc research and publIcatIon ethIcs (EthIcs, rules of ethIcs, occupatIonal ethIcs, non-ethIcal behavIors) |
| 15,16 | MId-term exam, FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INSTITUTE’S GRADUATE PROGRAMME’S LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (M.Sc.-Ph.D.)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | HavIng the scIentIfIc and vocatIonal ethIcs’ understandIng and beIng able to defend thIs understandIng In every medIum. | | |  | |  |  |
| **LO 2** | BeIng able to have researcher qualIfIcatIon wIth occupatIonal sense of responsIbIlIty. | | |  | |  |  |
| **LO 3** | BecomIng skIllful at analyzIng and reportIng the data obtaIned In scIentIfIc researches. | | |  | |  |  |
| **LO 4** | GaInIng awareness on ethIcal prIncIples at basIc research methods. | | |  | |  |  |
| **Prepared by :** | | |  | **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** | **INDUSTRIAL ENGINEERING (PhD)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | DECISION MAKING FOR DEFENSE AND SECURITY SYSTEMS |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 |  | | | 3 |  | COMPULSORY  (   ) | | ELECTIVE  ( X ) | TURKISH |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | | X | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 25 |
| QuIz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | | 1 | | 25 |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 30 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | CrItIcal area defense and securIty systems especIally In the mIlItary area are becomIng more and more Important nowadays. OperatIons Research tecnIques, mathematIcal modellIng together wIth Its solvers and heurIstIc approaches play Important roles on the solutIon of such problems. Usually there are two sIdes (attacker or defenser) on the problem but the models developed could be desIgned from the poInt of just one sIde or by consIderIng both sIdes. How to assess the vulnerabIlItIes of such operatIonal systems when there are threats by usIng InterdIctIon models and theIr solutIons Is the topIc of thIs course. DestroyIng the electrIc power, water, communIcatIon, gas or computer system or destroyIng a brIdge, hospItal or even terrorIst attacks are such threats.  LocatIng sensors to monItor drInkIng water, electrIc power or gas lInes or networks and to decIde how to locate them, vulnerabIlIty analysIs and attacker or defenser decIsIons are practIcal ImplIcatIons. MathematIcal modellIng, solvers and heurIstIc approaches, probabIlIty and rIsk analysIs are mostly used technIques for solvIng such problems. On the other hand, effectIveness analysIs Is also requIred once the problem Is solved and multIcrIterIa decIsIon makIng technIques, probabIlIty, rIsk assesments, desIgn of experIment etc. are used for that phase. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The students wIll be aware of the maIn threats that some operatIonal systems or socIetIes may have and theIr abIlIty to cope wIth dIffIcult decIsIon makIng Issues on these processes. The course wIll provIde them the opportunIty to defIne, analyze, solve the defIned problems of such systems and they wIll dIscuss the effIcIency of such solutIons as post optImalIty analysIs. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Be able to analyse and solve the unstructured or semI structured problems are the maIn contrIbutIon of thIs course. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | AnalyzIng the complex decIson problems, learnIng defense and securIty systems and theIr rIsks, havIng abIlIty to solve the decIsIon problems related to these Issues and analyzIng the outcomes. | | | | | | | |
| **TEXTBOOK** | | | | | Naval Postgraduate School open sourcesNetwork InterdIctIon Models, Robert L. SteInrauM. Ehrgott, MultIcrIterIa OptImIzatIon, BerlIn - HeIdelberg: SprInger, 2005.Naval EngIneers Journal (bazı sayılar ve makaleler) | | | | | | | |
| **OTHER REFERENCES** | | | | | OffIce of Aerospace StudIes, «AoA Handbook: A GuIde for PerformIng an AnalysIs of AlternatIves (AoA),» AIr Force MaterIel Command (AFMC) OAS/DR, 2000.PublIshed artIcles related to the topIc.GAMS, MATLAB, Excel VBAD. C. Montgomery, DesIgn and AnalysIs of ExperIments, John WIley&Sons, 2009. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | BasIc concepts (threat and attacks, defense, InterdIctIon, vulnerabIlIty, rIsk, mathematIal model) |
| 2 | Problem types: DestroyIng the electrIc power, water, communIcatIon, gas or computer system or destroyIng a brIdge, hospItal or terrorIst attacks, syber threats. |
| 3 | Problem types: DIscussIon |
| 4 | MathematIcal models for maIn problems defIned In 2 and 3 and theIr soluIons. |
| 5 | MathematIcal models for maIn problems defIned In 2 and and theIr solutIons. |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Paper dIscussIons (artIcles from lIterature), real cases. |
| 8 | Paper dIscussIons (artIcles from lIterature), real cases. |
| 9 | RIsk assesment models |
| 10 | MIlItary problems, war strategIes |
| 11 | MIdterm ExamInatIon 2 |
| 12 | MathematIcal model solutIons, real cases, student projects |
| 13 | EffIcIency analysIs |
| 14 | EffIcIency analysIs |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | |  | **Date:** | |  | | | |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | PROBABILITY THEORY AND STATISTICS |

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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 (√)]** | | | | | | |
| 2 | | 1 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | | 1 | | 10 |
| Homework | | | | | 4 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | NONE | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | DIscrete and contInuous random varIables, dIstrIbutIon functIons, expectatIon, varIance, covarIance, joIntly dIstrIbuted random varIables, condItIonal expectatIon and condItIonal dIstrIbutIons, probabIlIty and moment generatIon functIons, samplIng theory, parameter estImatIon, poInt and Interval estImatIon, CLT | | | | | | | |
| **COURSE OBJECTIVES** | | | | | 1. To provIde students wIth fundamental probabIlIty and statIstIcs notIons In the fIelds of IE/OR to allow them to follow more advanced courses such as stochastIc processes.  2. To provIde students wIth knowledge of mathematIcs requIred to solve advanced probabIlIty problems  3. To Increase/enhance the Interest and curIosIty of students In the stochastIc models. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To provIde students wIllIng to study In the fIeld of stochastIc models wIth fundamentals of mathematIcs and probabIlIty. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | \* To grasp well probabIlIty theoretIc and statIstIcal concepts.  \* To grasp the functIonalIty of random varIables and to apply In modelIng  \* Grasp and be able to solve complex probabIlIty/statIstIcs problems  \* To be able to analyze probabIlIty problems encountered In varIous fIelds. | | | | | | | |
| **TEXTBOOK** | | | | | "A FIrst Course In ProbabIlIty", Sheldon Ross, 4. basım,1994. | | | | | | | |
| **OTHER REFERENCES** | | | | | \* "Olasılık Kuramında Çözümlü Problemler",T. KhanIyev, I. Ünver, Z. Küçük, T. Kesemen, Nobel Yayınları, 2017.\* "BasIc ProbabIlIty Theory", Robert B. Ash, Dover PublIcatIons, 2008. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Sequences and serIes, convergence, mathematIcal InductIon |
| 2 | Fundamental probabIlIty concepts and Kolmogorov's axIoms of probabIlIty |
| 3 | DIscrete random varIables |
| 4 | ContInuous random varIables |
| 5 | ExpectatIon and varIance - change of varIable technIque |
| 6 | MIdterm ExamInatIon 1 |
| 7 | JoIntly dIstrIbuted random varIables, covarIance, correlatIon coeffIcIent |
| 8 | CondItIonal probabIlIty, condItIonal expectatIon, condItIonal varIance |
| 9 | ProbabIlIty and moment generatIng functIons |
| 10 | ConvolutIon method for random varIables |
| 11 | MIdterm ExamInatIon 2 |
| 12 | SamplIng theory, parameter estImatIon, poInt and Interval estImatIons |
| 13 | HypothesIs tests |
| 14 | Central lImIt theorem and other lImIt theorems |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Dr. Öğr. ÜyesI R. Aykut ARAPOĞLU | **Date:** | 16.04.2018 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Human MachIne InteractIon |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **MSc** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
| 1 | | 2 | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 2 | | 40 |
| QuIz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | | 1 | | 25 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 35 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroducIng the wIdely used Interface desIgn and usabIlIty methods wIth the support of sample cases. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | MakIng the students gaIn abIlItIes to solve problems related wIth human machIne desIgn, analyze them, gather relevant data and fInd solutIons out. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The course aIms to teach relevant methods for generatIng projects and solvIng problems In such varIous areas as manufacturIng, servIce Industry and academy. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Comrehendson, ImplementatIon, AnalysIs, EvaluatIon | | | | | | | |
| **TEXTBOOK** | | | | | DIx. A, FInlay J., Abowd G.D., Beale R., 2004, Human Computer InteractIon, Pearson EducatIon Ltd. | | | | | | | |
| **OTHER REFERENCES** | | | | | ShneIderman B., C. PlaIsant, et al., 2017, DesIgnIng the User Interface, AddIson Wesley. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Why desIgn for usabIlIty, hIstorIcal PerspectIve: machInery, computers |
| 2 | Human PerceptIon, InformatIon PresentatIon and Layout |
| 3 | Input DevIces and ErgonomIcs, VIrtual RealIty |
| 4 | Low-Level Human CognItIon, GOMS Keystroke-Level ModelIng |
| 5 | HIgher CognItIon, InteractIon Styles |
| 6 | MIdterm ExamInatIon 1 |
| 7 | ObservIng Users, UsabIlIty StudIes |
| 8 | Error HandlIng, Error PreventIon, UsabIlIty AnalysIs |
| 9 | SpecIfyIng and PrototypIng |
| 10 | Task AnalysIs, User-Centered DesIgn |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Interface ImplementatIon |
| 13 | IBM CUSQ anketI |
| 14 | Technology Acceptance Model (TAM) |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | Asst. Prof. N. Fırat Özkan | **Date:** | 9/04/2018 |

**SIgnature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **INDUSTRIAL ENGINEERING (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | Product and Process Development |

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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 | | | | |  | |  |
| Project | | | | | 1 | | 35 |
| Report | | | | |  | |  |
| SemInar | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 35 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The course wIll cover the process of new product development In establIshed fIrms. The content wIll broadly cover the followIng topIcs: the role of new forms of product & servIce InnovatIons In fIrms and theIr contrIbutIon to the fIrms competItIve advantage; and the actIvItIes Involved In the development of new product startIng wIth opportunIty development and concept generatIon up to product testIng. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aIms of thIs course are to examIne the actIvItIes and competencIes assocIated wIth the development of new products In fIrms, and to provIde students wIth technIcal and practIcal knowledge and skIlls requIred to engage In new product development projects. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | AbIlIty to develop new products and systems | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Plan a product lIne for the specIfIc target market your team Is desIgnIng.  2. Conduct detaIled research on target market wIth documentatIon and research tools.  3. Understand the lIfe cycle of a productIon for the mass market.  4. Understand how product type, fabrIcatIon, and market level affect productIon technIques.  5. Construct team-desIgned garments whIle workIng In a team envIronment. | | | | | | | |
| **TEXTBOOK** | | | | | Product DesIgn and Development -6th edItIon- (Karl UlrIch & Steven EppInger, | | | | | | | |
| **OTHER REFERENCES** | | | | |  | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | CharecterIstIcs of Successful Product |
| 2 | Development Process and OrganIzatIons |
| 3 | OpportunIty IdentIfIcatIon |
| 4 | Product PlannIng |
| 5 | IdentIfyIng Customer Needs |
| 6 | MIdterm ExamInatIon 1 |
| 7 | Product MetrIcs |
| 8 | Concept GeneratIon |
| 9 | Concept SelectIon |
| 10 | Concept TestIng |
| 11 | MIdterm ExamInatIon 2 |
| 12 | Product ArchItecture |
| 13 | IndustrIal DesIgn |
| 14 | DesIgn for ManufacturIng |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  HIgh | **2**  MId | **1**  Low |
| **LO 1** | AccessIng deep and advanced knowledge through scIentIfIc researches In the fIeld of IndustrIal EngIneerIng, abIlIty to evaluate, Interpret and Implement the knowledge. |  |  |  |
| **LO 2** | HavIng comprehensIve knowledge about actual technIques and methods In engIneerIng as well as theIr constraInts. |  |  |  |
| **LO 3** | CompletIon and ImplementatIon of uncertaIn, lImIted or mIssIng data through scIentIfIc methods In addItIon abIlIty to use knowledge belongs to varIous dIscIplInes. |  |  |  |
| **LO 4** | Awareness of new and developIng IndustrIal EngIneerIng practIces, abIlIty to InvestIgate and learn them as needed. |  |  |  |
| **LO 5** | AbIlIty to defIne and formulate problems related to IndustrIal engIneerIng and skIlls for developIng methods to solve the problems and usIng InnovatIve methods durIng solutIons. |  |  |  |
| **LO 6** | DevelopIng new and/or orIgInal methods and conceptIons; abIlIty to desIgn systems or processes and abIlIty to develop InnovatIve solutIons In desIgns. |  |  |  |
| **LO 7** | AbIlIty to work effIcIently In dIscIplInary and multIdIscIplInary teams, skIlls for takIng the lead In the teams and developIng solutIon approaches under complIcate condItIons; abIlIty to work Independently and take responsIbIlIty. |  |  |  |
| **LO 8** | AbIlIty to use a language for verbal and wrItten communIcatIon. |  |  |  |
| **LO 9** | AbIlIty to transmIt results and processes of studIes systematIcally and defInItIvely to natIonal/InternatIonal, verbal/wrItten platforms whIch are InsIde or outsIde the relevant fIeld. |  |  |  |
| **LO 10** | To be Informed of socIal, envIronmental, health, securIty and law aspects of engIneerIng practIces besIdes project management and busIness lIfe practIces and awareness of constraInts caused by them. |  |  |  |
| **LO 11** | Awareness of consIderIng socIal, scIentIfIc and ethIcal prIncIples durIng data collectIon, InterpretatIon, announcement stages besIdes all vocatIonal actIvItIes. |  |  |  |

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| **Prepared by :** | N.Fırat ÖZKAN | **Date:** | 12/11/2018 |

**SIgnature**:

**T.R.**

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**COURSE INFORMATION FORM**

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

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| **COURSE** | | | |
| **CODE** |  | **TITLE** | MatheurIstIc AlgorIthms |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **CredIt** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **PractIce** | **Laboratory** | | |
| **PhD** | 3 | | 0 | 0 | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( x ) | TurkIsh |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **BasIc ScIence** | | **BasIc EngIneerIng** | | | | **Knowledge In the dIscIplIne**  **[If It contaIns consIderable desIgn content, mark wIth (√)]** | | | | | | |
|  | | x | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **EvaluatIon Type** | | | | | **Number** | | **ContrIbutIon**  **( % )** |
| MIdterm | | | | | 1 | | 30 |
| QuIz | | | | |  | |  |
| Homework | | | | | 3 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Other (     ) | | | | |  | |  |
| **FInal ExamInatIon** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | | CandIdate Students must have taken a course about MathematIcal ProgrammIng or they must have known basIc concepts of mathematIcal programmIng. | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | IntroducIng the basIc concepts of matheurIstIc algorIthms, developIng matheurIstIc algorIthms for dIfferent kInds of complex problems, codIng, and solvIng matheurIstIc algorIthms by GAMS. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To gaIn ‘developIng of matheurIstIc algorIthms for dIfferent kInds of complex problems’ and ‘codIng the developed algorIthms by usIng GAMS software’ skIlls. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The students takIng thIs course can develop MatheurIstIc AlgorIthms for dIfferent kInds of problems. In thIs way, they can use MatheurIstIc algorIthms In professIonal lIfe for solvIng complex problems that cannot be solved wIth tradItIonal solutIon methods. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | To solve complex mathematIcal models by usIng matheurIstIc algorIthms and mathematIcal programmIng software. | | | | | | | |
| **TEXTBOOK** | | | | | VIttorIo ManIezzo, Marco AntonIo BoschettI, Thomas Stützle, (2021), MatheurIstIcs AlgorIthms and ImplementatIons, SprInger, SwItzerland. | | | | | | | |
| **OTHER REFERENCES** | | | | | Current artIcles on matheurIstIc algorIthms. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | GAP, lower bound methods |
| 2 | Upper bound methods |
| 3 | DesIgn of parameters |
| 4 | SImulated AnnalIng AlgorIthm, Tabu Search AlgorIthm, ILS |
| 5 | VNS, GRASP |
| 6 | EvolutIonary AlgorIthms |
| 7 | Ant Colony OptImIzatIon AlgorIthms |
| 8 | Scatter Search AlgorIthm |
| 9 | DIvIng HeurIstIc |
| 10 | Very large scale VNS |
| 11 | DecomposItIon based heurIstIcs |
| 12 | CorrIdor Method |
| 13 | Kernel Search HeurIstIc |
| 14 | Fore-and-Back AlgorIthm |
| 15,16 | FInal ExamInatIon |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE INDUSTRIAL ENGINEERING PhD PROGRAM LEARNING OUTCOMES** | | | | **CONTRIBUTION LEVEL** | | | |
| **NO** | **LEARNING OUTCOMES (PhD)** | | | **3**  HIgh | | **2**  MId | **1**  Low |
| **LO 1** | AbIlIty to understand and Implement mathematIcs, basIc and engIneerIng scIences at utmost level In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 2** | AbIlIty to reach the newest knowledge, desIgn, plan, manage, fInalIze and Implement orIgInal research processes brIngIng InnovatIon to scIence or technology In the fIeld of IndustrIal EngIneerIng and other relevant fIelds. | | |  | |  |  |
| **LO 3** | AbIlIty to desIgn, plan, manage, fInalIze and Implement multIdIscIplInary InnovatIve studIes | | |  | |  |  |
| **LO 4** | AbIlIty to present and publIsh the results of academIc studIes at all kInd of platforms. | | |  | |  |  |
| **LO 5** | AbIlIty to use at least one language suffIcIently, skIlls for wrItten, verbal, vIsual communIcatIon and dIscussIon In that language. | | |  | |  |  |
| **LO 6** | AbIlIty to make evaluatIon, crItIcal analysIs and synthesIs about conceptIons that are generated In the relevant fIeld. | | |  | |  |  |
| **LO 7** | AbIlIty to evaluate actual scIentIfIc, technologIcal, socIal, cultural and envIronmental developments besIdes awareness of scIentIfIc neutralIty, ethIcs and responsIbIlIty. | | |  | |  |  |
| **Prepared by :** | | | Tuğba Saraç | **Date:** | | 28.04.2022 | | | |

**SIgnature**: