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|  | **ECTS Course Description Form** |
| **PART I ( Senate Approval)** |
| **Offering School**  | College of Engineering |
| **Offering Department** | Industrial Engineering |
| **Program(s) Offered to** | Industrial Engineering | Compulsory |
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| **Course Code**  | IE 303 |
| **Course Name** | Operations Research III |
| **Language of Instruction** | English |
| **Type of Course** | Compulsory Course |
| **Level of Course** | Undergraduate |
| **Hours per Week** | **Lecture:** 3 hour | **Laboratory:** | **Recitation:** 1  | **Practical:**  | **Studio:** | **Other:** |
| **ECTS Credit** | 6 |
| **Grading Mode** | Letter Grade |
| **Pre-requisites** | IE 202 and MATH 211 |
| **Co-requisites** |  |
| **Registration Restriction** |  |
| **Educational Objective** | This course covers fundamental methods of nonlinear optimization, with a focus on nonlinear programming models. Emphasis in this course will be on nonlinear optimization approaches to reach the best solution and understanding how these methods work. |
| **Course Description** | Introduction to Nonlinear Programming and Network Models, Shortest-Path Problems, Maximum-Flow Problems, CPM and PERT, Minimum-Cost Network Flow Problems, Solving NLPs with One Variable, Golden Section Search, Unconstrained Maximization and Minimization with Several Variables, The Method of Steepest Ascent and Lagrange Multipliers, Other NLP Methods |
| **Learning Outcomes**  | **LO1** | * Apply classical methods of optimization to problems that may be formulated using nonlinear functions
* Apply optimization to network flow problems
* Use nonlinear programming to solve nonlinear problems
* Learn how to model nonlinear programming problems with Variables
* Learn how to model nonlinear programming problems with Golden Section and Kuhn Tucker Methods
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| **LO2**  |
| **LO3** |
| **LO4** |
| **LO5** |
| **PART II ( Faculty Board Approval)** |
| **Basic Outcomes (University-wide)** | **No.** | Program Outcomes | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** |  |
| **PO1** | Ability to communicate effectively and write and present a report in Turkish and English.  | 🗸 🗸 🗸 🗸 🗸🗸 🗸 🗸 🗸 🗸🗸 🗸 🗸 🗸 🗸🗸 🗸 🗸 🗸 🗸🗸 🗸 🗸 🗸 🗸🗸 🗸 🗸 🗸 🗸 |
| **PO2** | Ability to work individually, and in intra-disciplinary and multi-disciplinary teams. |
| **PO3** | Recognition of the need for life-long learning and ability to access information, follow developments in science and technology, and continually reinvent oneself. |
| **PO4** | Knowledge of project management, risk management, innovation and change management, entrepreneurship, and sustainable development. |
| **PO5** | Awareness of sectors and ability to prepare a business plan. |
| **PO6** | Understanding of professional and ethical responsibility and demonstrating ethical behavior. |
| **Faculty Specific Outcomes** | **PO7** |  |
| **PO8** |  |
| **PO9** |  |
| **PO10** |  |
| **PO11** |  |
| **PO12** |  |
| **Discipline Specific Outcomes (program)** | **PO13** |  |
| **PO14** |  |
| **PO15** |  |
| **PO16** |  |
| **PO17** |  |
| **PO18** |  |
| **Specialization Specific Outcomes** | **PO N….** |  |
| **PART III ( Department Board Approval)** |
| **Course Subjects, Contribution of Course Subjects to Learning Outcomes, and Methods for Assessing Learning of Course Subjects** | **Subjects** | **Week** |  | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
| **S1** | 1 | Introduction to Nonlinear Programming and Network Models | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S2** | 2 | Shortest-Path Problems | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S3** | 3 | Maximum-Flow Problems | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S4** | 4 | CPM and PERT | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S5** | 5 | CPM and PERT | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S6** | 6 | Minimum-Cost Network FlowProblems | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S7** | 7 | Solving NLPs with One Variable | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S8** | 8 | Golden Section Search | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S9** | 9 | Unconstrained Maximization andMinimization with Several Variables | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S10** | 10-12 | The Method of Steepest Ascent and Lagrange Multipliers | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **S11** | 13-14 | Other NLP Methods | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 | A1, A2, A3 |  |
| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules**  | **No.** | **Type** | **Weight** | **Implementation Rule** | **Make-Up Rule** |
| **A1** | **Exam** | 65% | *No electronic devices are allowed in the examinations except for calculators.* | *If an exam is missed, a make-up exam may be granted if student’ absence from the exam is because of a valid and documented excuse.* |
| **A2** | **Quiz** | 10% | *No electronic devices are allowed in the examinations except for calculators.* | *If an exam is missed, a make-up exam may be granted if student’ absence from the exam is because of a valid and documented excuse.* |
| **A3** | **Homework** | 20% | *Submission by the deadline* | *Late homework is penalized by a percentage* |
| **A4** | **Project** | - | *-* | - |
| **A5** | **Report** | - | - | - |
| **A6** | **Presentation** | - | - | - |
| **A7** | **Attendance/ Interaction** | 5% | - | *No compensation, no makeup* |
| **A8** | **Class/Lab./****Field Work** | - | - | - |
| **A9** | **Other** | - | - | - |
| **TOTAL** | **100%** |
| **Evidence of Achievement of Learning Outcomes** | *%70 course attendance and gaining 70% or more on taken exams and other assignments.*  |
| **Method for Determining Letter Grade** | *The %70 total attendance is required otherwise student will fail the course due to absenteeism. Letter grades are determined by applying catalogue system on student’s total weighted grade. Following is an example:*≥ 97% A+[93 97) A[90 93) A-[87 90) B+[83 87) B[80 83) B-[77 80) C+[73 77) C[70 73) C-[67 70) D+[60 67) D< 60 F |
| **Teaching Methods, Student Work Load** | **No** | **Method** | **Explanation** | **Hours** |
| ***Time applied by instructor*** |
| **1** | **Lecture** | *(14 weeks) × (3 hrs per week)* | *42* |
| **2** | **Interactive Lecture** |  |  |
| **3** | **Recitation** | *(14 weeks) × (1 hr per week)* | *14* |
| **4** | **Laboratory** |  |  |
| **5** | **Practical** |  |  |
| **6** | **Field Work** |  |  |
| ***Time expected to be allocated by student*** |
| **7** | **Project** |  |  |
| **8** | **Homework** | *(14 weeks) × (2 hrs per week)* | *28* |
| **9** | **Pre-class Learning of Course Material**  | *(14 weeks) × (1 hr per week)* | *14* |
| **10** | **Review of Course Material** | *(14 weeks) × (3 hrs per week)* | *42* |
| **11** | **Studio** |  |  |
| **12** | **Office Hour** | *(14 weeks) × (3 hrs per week)* | *42* |
| **TOTAL** |  182 |
| **IV. PART** |
| **Instructor** | **Name** | *Assist.Prof. M.Fatih AK* |
| **E-mail** | *fatih.ak@antalya.edu.tr* |
| **Phone Number** |  |
| **Office Number** | *AG-05* |
| **Office Hours** |  |
| **Course Materials** | **Mandatory** |  |
| **Recommended** |  |
| **Other** | **Scholastic Honesty** | Violations of scholastic honesty include, but are not limited to cheating, plagiarizing, fabricating information or citations, facilitating acts of dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. Any form of scholastic dishonesty is a serious academic violation and will result in a disciplinary action. |
| **Students with Disabilities** | Reasonable accommodations will be made for students with verifiable disabilities. |
| **Safety Issues**  | The course does not require any special safety precautions. |
| **Flexibility** | Circumstances may arise during the course that prevents the instructor from fulfilling each and every component of this syllabus; therefore, the syllabus is subject to change.  Students will be notified prior to any changes. |