**EASTERN MEDITERRANEAN UNIVERSITY**

**DEPARTMENT OF INDUSTRIAL ENGINEERING**

**IENG511 Optimization Theory**

**Course Outline**

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| **COURSE CODE** |  IENG511 | **SEMESTER / ACADEMIC YEAR** |  Spring 2024-25 |
| **COURSE TITLE** |  Optimization Theory |
| **CREDIT VALUE** |  (3, 0, 0) 3 |
| **LECTURER(S)** |  Asst. Prof. Dr. Sahand DANESHVAR |  sahand.daneshvar@emu.edu.tr  | IE-C109 |  +90 392 630 2773 |
| **COURSE TYPE** | Elective |
| **PRE-REQUISITE(S)** | Consent of the instructor |
| **DURATION OFCOURSE** | 14 Weeks |
| **COURSE SCHEDULE** | Wednesday 09:30-12:20 IE-E201, except 05.03.2025 (Makeup class will be held on Friday 28.03.2025 at 09:30 for three class hours in IE-E201). |
| **COURSE WEB LINK** | http://staff.emu.edu.tr/sahanddaneshvar/en  |
| **COURSE DESCRIPTION**Convex analysis; Optimality conditions; Generalized linear programming; Simplex method, Matrix representation; Duality; Integer programming; Computer applications. Extensions of linear programming; Dynamic programming; Methods for unconstrained and constrained non-linear optimization; Multi-objective optimization methods. |
| **AIMS & OBJECTIVES**The aim of this course is to introduce the fundamental concepts of polyhedral theory and duality theory of linear and non-linear programming. These concepts are applied in algorithms of optimization. Special problems and methods of linear and non-linear optimization are discussed as well.  |
| **GENERAL LEARNING OUTCOMES (COMPETENCES)**On successful completion of this course, all students will have developed **knowledge** and **understanding** of:* Convexity,
* Linear programming,
* Farkas’ lemma and theorem,
* Simplex method,
* Optimality conditions,
* Duality
* Integer Programming,
* Unconstrained non-linear optimization,
* Constrained non-linear optimization,

On successful completion of this course, all students will have developed **their skills in**:* Analyzing optimization problems,
* Finding optimality condition of optimization problems,
* Explore the special properties of structured problems.
* Solving optimization problems numerically.

On successful completion of this course, all students will have developed their appreciation of and respect for **values and attitudes** regarding the issues of: * To the concept and application of duality,
* Construction of algorithms for well-structured problems
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|  **GRADING CRITERIA****Exams:** All examinations and assignments will be based on the lectures and tutorials. Assignments will be to hone the problem skills of the students. Students will be encouraged to go through their answer scripts and clarify their omissions and mistakes, if any. Descriptions of the examinations are as follows:*Midterm Exam:* There will be one such examination covering all the teaching material up to the 8th week. This exam held on 16 April *2025(09:30-11:20)* which is not flexible.*Final Exam:* The final examination will cover all the material studied throughout the semester specially after 9th week, and has the same structure as the midterm examination. It will also be used to determine letter grades. Final exam held on 11 June *2025 (09:30-11:20)*. *Quizzes:* There will be two quizzes that will held on  *26* March *2025 (09:30-10:20)* and *21* May *2024 (09:30-10:20)* respectively which are not felixible.*Assignments:* Six Homeworks in the form of assignments will be given to assess students’ problem-solving ability. The dead line for submission each of them is **one week** after it is presented on course web link. Late submissions will not be valued.Note: The voluntary paper presentation has (5%) bonus. Topics will be given by the instructor. |
| **LEARNING / TEACHING METHOD**Teaching will enable the students to understand the application of various statistical processes control methods. The function of teaching is to enable students to learn. Therefore students are required to read the chapters of the textbook before coming to class and solve the related homework questions after each lecture. The instructor will lecture in class by writing on the board and some lectures will be given as a MS power point presentation. Also the lectures will be supplemented by tutorial sessions. |
| **READING ASSIGNMENTS**Besides the textbook material, there will be some reading assignments, which will support the lectures. For any type of examination, students are also responsible from studying all assigned readings, even if they might not be discussed in class. |
| **METHOD OF ASSESSMENT**Although the student’s overall grade will be based on the general assessment of the instructor, the following percentages may give an idea about the relative importance of various assessment tools. Quizzes 16 % Homework 24 % Mid-term Exam 25 % Final Exam 35 % TOTAL 100 pointsNote that the instructor reserves the right to modify these percentages in case he finds it necessary. Letter grade equivalents of numerical performances will be announced by the Registrar’s Office after the last day for the submission of letter grades. |
| **ATTENDANCE**1. Attendance is mandatory. Any student who has poor attendance and/or misses an examination without providing a valid excuse will be given **NG** grade.
2. Students missing just on Midterm Exam should provide a valid excuse within three working days following the examination they missed. One make-up examination will be given at the end of the semester after the final examination period.
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| **TEXTBOOK/S**Students must refer the following textbooks:**Text Book**s: * *M.S. Bazaraa, C.M. Shetty, Nonlinear Programming, Second Edition, WILEY,1997*
* *M.S. Bazara, H.D. Sherali, Linear Programming and Network Flows, 4th Edition, 2007*

Reference Books: * *Hamdy A. Taha, Operations Research: An Introduction, Prentice Hall, 7th edition, 2003.*
* *Murty. Katta G, Operations Research: Deterministic Optimization Models, Prentice Hall,1995*

**CONTENT & SCHEDULE**The lecture topics within the semester are as in the following schedule although minor changes are possible:

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| **WEEK** | **TOPICS** |
| 1 | Basic concept: linear spaces and convexity |
| 2 | Extreme points of polyhedral sets  |
| 3 | Geometry of the simplex method |
| 4 | Simplex method |
| 5 | Optimality condition, FJ condition |
| 6 | Farkas theorem, KKT condition |
| 7 | Duality in linear programming |
| 8 | **Midterm Exam** |
| 9 | Integer programming II: Branch and Bound |
| 10 | Integer programming I: Enumeration |
| 11 |  Unconstrained optimization: Linear search |
| 12 |  Unconstrained optimization: Multidimensional search  |
| 13 |  Constrained optimization |
| 14 | Feasible Direction Methods  |
| 15 |  Optimality conditions |
| 16 | **Final Exam** |

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| **ACADEMIC HONESTY, PLAGIARISM & CHEATING**This is intentionally failing to give credit to sources used in writing regardless of whether they are published or unpublished. Plagiarism (which also includes any kind of cheating in exams) is a disciplinary offence and will be dealt with accordingly. According to university by laws cheating and plagiarism are serious offences punishable with disciplinary action ranging from simple failure from the exam or project/report, to more serious action (suspension from the university for up to one semester). Disciplinary action is written in student records and may appear in student transcripts. Any act not suitable for a university student will not be tolerated and may lead to formal disciplinary action. Example of this are: getting someone else to take the examinations for you, misrepresentation of your own answer sheet as another’s work, cheating, knowingly assisting other students to cheat, abusing the tolerance or breaking the discipline of the class. |

**PLEASE KEEP THIS COURSE OUTLINE FOR FUTURE REFERENCE AS IT CONTAINS IMPORTANT INFORMATION!!!**