**EASTERN MEDITERRANEAN UNIVERSITY**

**DEPARTMENT OF INDUSTRIAL ENGINEERING**

**IENG516 Network Flow**

**Course Outline**

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| **COURSE CODE** |  IENG516 | **SEMESTER / ACADEMIC YEAR** | Spring 2021-22 |
| **COURSE TITLE** | Network Flow |
| **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 Course |
| **PRE-REQUISITE(S)** | Consent of the instructor |
| **DURATION OFCOURSE** | 14 Weeks |
| **COURSE SCHEDULE** | Thursday 13:30-16:20 IE-E201, |
| **COURSE WEB LINK** | <http://staff.emu.edu.tr/sahanddaneshvar/en> |
| **COURSE DESCRIPTION**Network representation and terminology. Minimal Cost Network Flow problems, Transportation problem, Assignment problems, Other network flow problems such as Shortest Path, Minimal Spanning Tree and Maximal Flow problems. Graph Theory, Out-of-Kilter Algorithm. |
| **AIMS & OBJECTIVES**The main aims/objectives of this course are:* To introduce the fundamental definitions and notions of Graph Theory,
* To introduce the fundamental algorithmic concepts of Network Flows,
* To develop the need of network flow in real life problems,
* To improve application skills in network flows problems,
* To use these skills for research on any other combinatorial type of industrial engineering problem.

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| **GENERAL LEARNING OUTCOMES (COMPETENCES)**On successful completion of this course, all students will have developed **knowledge** and **understanding** of:* Graph theory,
* Shortest path problem,
* Maximal flow problem,
* Minimal cost flow problem,
* Network simplex method,
* Polyhedral theory of graph optimization problems,
* Duality in network flows problems,
* Transportation and assignment problem,
* Bounded variables in network flow problems.

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,
* Applying graph models for real life problems.

On successful completion of this course, all students will have developed their appreciation of and respect for **values and attitudes** regarding the issues of:* The complexity of algorithms,
* 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 19 April 2022 (13:30-15:20) which is not flexible.**Final Exam: The final examination will cover all the material studied throughout the semester, and has the same structure as the midterm examination. It will also be used to determine letter grades. Final exam held on 14 June 2022 (13:30-15:20).* *Quizzes: There will be two quizzes that will held on 29 March 2022 (15:30-16:20) and 24 May 2022 (15:30-16:20) respectively which are not flexible.**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.*Make-up Exam:* **No make-up examination will be given to students who miss quizzes, and whose attendance is below 70%.** Make-up examination will only be offered to students who missed the **final, midterm and lab exams** and provided adequate documentations for the reason for their absence within five working days at the latest after the examination date. A student’s illness will only be accepted as a valid excuse if it is supported by a written report from the Health Center. 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.   Homework 24 % Quizzes 16 % 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 AND NG GRADE**Attendance will be taken every Lecture/Tutorial/Lab session. Note that EMU regulations allow instructors to give a grade of **NG** (Nil Grade) to a student whose absenteeism is more than 30% of the Lecture/Tutorial/Lab hours and/or who do not complete sufficient work that are included in the assessment of the course. |
| **TEXTBOOK/S**Students must refer the following textbooks:**Text Book**s: * *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 | Fundamental definitions and notions of Graph Theory |
| 2 | Network Flow problem |
| 3 | Properties of the Network Flow problem technological matrix |
| 4 | The simplex method for Network Flow problem |
| 5 | Duality in network flows problems |
| 6 | Network Flow problem with bounded variables |
| 7 | Midterm Exam |
| 8 | Transportation problem |
| 9 | Assignment problem |
| 10 | Shortest path problem |
| 11 | Minimal spanning tree  |
| 12 | Maximal flow problem |
| 13 | Out-of-Kilter Algorithm |
| 14 | Student presentations |

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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!!!**