EASTERN MEDITERRANEAN UNIVERSITY
DEPARTMENT OF INDUSTRIAL ENGINEERING
IENG441/MANE441 FACILITIES PLANNING AND DESIGN
COURSE OUTLINE

COURSE CODE	IENG441/MANE441	**COURSE LEVEL**	Fourth Year
COURSE TITLE	Facilities Planning and Design	**COURSE TYPE**	Area Core
CREDIT VALUE	(4, 1, 0) 4	**ECTS Credit Value**	8
PRE-REQUISITE(S)	Senior standing, IENG301/MANE301	**CO-REQUISITE(S)**	IENG332/MANE332
PREPARED BY	Prof. Dr. Orhan KORHAN	**SEMESTER / ACADEMIC YEAR**	FALL 2022-23

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COURSE SCHEDULE	Lecture: Wednesday 10:30-12:20 (IE-D201), Friday 10:30-11:20 (IE-D203) Tutorial: Monday 09:30-10:20 (IE-D203) Office Hour: Wednesday 09:30-10:20			
COURSE WEB LINK	**https://staff.emu.edu.tr/orhankorhan/en/teaching/ieng441-mane441**			

COURSE DESCRIPTION

The purpose of this course is to make an introduction to planning and design of manufacturing facilities from an industrial engineering point of view. A balance of traditional and analytical approaches to facilities planning will be presented: Principles of manufacturing and facility organization, Capacity and technology selection, Analysis of production plans and processes to compute equipment and manpower requirements, Facility location, Plant layout, Identification of production support activities: receiving, inventory management, material handling, storage and warehousing, packaging and shipping, maintenance planning.

COURSE OBJECTIVES

The main objectives of this course are:

1. Significance of facilities planning (objectives, applications, design), logistic management (location problems, allocation problem, location-allocation problems) (Contributing Student Outcome 1)
2. Modeling and solving discrete space location problems (Qualitative, Quantitative, Hybrid), continuous space location problems (Median, Gravity, Weizsfeld), Contour Line Method (Contributing Student Outcome 1)
3. Modeling and solving advanced location problems (multi-facility location problems using Euclidean, squared Euclidean, and rectilinear distances) (Contributing Student Outcome 1)
4. Modeling and solving Allocation problems (Two-stage transportation model) (Contributing Student Outcome 1)
5. Modeling and solving Location – Allocation problems (Set Covering, Uncapacitated Location-Allocation model, Comprehensive Location-Allocation model) (Contributing Student Outcome 1)
6. Developing facilities planning strategies and discussion of inadequate planning (Contributing Student Outcome 7)
7. Product design (exploded assembly drawing, component part drawing) (Contributing Student Outcome 2)
8. Process design (part list, BOM, route sheet, assembly chart, operation process chart, precedence diagram) (Contributing Student Outcome 2)
9. Schedule design (scrap estimates, equipment fractions), facilities design (affinity diagram, interrelationship diagraph, tree diagram, matrix diagram, contingency diagram, activity network diagram, prioritization matrix) (Contributing Student Outcome 1)
10. Departmental planning, manufacturing cells (Direct Clustering Algorithm), activity relationships, flow patterns (planning and measuring flow), space requirements (Contributing Student Outcome 1)
11. Personnel requirements (parking, restroom, health services, cafeteria) (Contributing Student Outcomes 1, 4)
12. Materials handling system (unit load, material handling equipment) (Contributing Student Outcome 2)
13. Layout design (construct type: Systematic Layout Procedure, improvement type: Pairwise-Exchange Method) (Contributing Student Outcome 1)
14. Working effectively in multidisciplinary teams, making an independent research for real life cases, and writing and presenting a technical report on the results (Contributing Student Outcomes 1, 2, 3, 5, 6)

COURSE LEARNING OUTCOMES

On successful completion of this course, students are expected to develop **knowledge** and **understanding** of:

1. Classification of location problems, and their definitions
2. Formulation of location problems; their objectives, constraints and applicable solution techniques
3. Alternative distance metrics and their use
4. Demand forecasting and market analysis
5. Facilities design in terms of product, process and schedule design

6. Facilities requirements planning in terms of man, machine and material requirements
7. Flow, space and activity relationship planning and departmentalization
8. Material handling systems design
9. Warehouse design
10. Personal requirements and plant support services
11. Alternative layout types
12. Available layout procedures and computerized solution techniques

On successful completion of this course, students are expected to develop **their skills** in:

13. Solving basic facilities location problems
14. Formulating advanced facilities location problems
15. Solving linear and mixed linear integer programming formulations using LINGO/LINDO
16. Using MS Excel in numerical problem solving
17. Surveying, gathering and analysis of data for planning purposes
18. Solving plant layout problems
19. Generating layout alternatives using computer software)
20. Evaluation of alternative facilities plans
21. Both written and oral presentation of the project study

On successful completion of this course, students are expected to develop their appreciation of and respect for **values and attitudes** regarding the issues of:

22. Role of Industrial Engineering in Facilities Planning and Design
23. Acting in a team for the team's objectives
24. Importance of location problem in real life
25. Necessity for formulating viable alternatives to facilities planning projects
26. Impact of human factors in generating design alternatives
27. Importance of accuracy in estimating market share, demand, relevant costs and all requirements and the sensitivity of results to these values
28. Impact of computer technology in solving Industrial Engineering problems

CONTRIBUTION OF THE COURSE TO MEETING THE REQUIREMENTS OF CRITERION 5

Mathematics and Basic Sciences : 0
Engineering Topics : 4 (✓)
General Education : 0

RELATIONSHIP OF COURSE TO STUDENT OUTCOMES

	Level of Contribution		
Student Outcomes	**Moderate**	**High**	**NO**
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	☐	☑	☐
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	☑	☐	☐
3. an ability to communicate effectively with a range of audiences	☑	☐	☐
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	☑	☐	☐
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	☑	☐	☐
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	☑	☐	☐
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	☑	☐	☐

GRADING CRITERIA

Exams: All examinations will be based on lectures, tutorials, labs, assigned readings, project study or other work. To pass these exams students will need to have studied the material well in advance in order to understand the concepts, procedures and techniques. To discourage last minute cramming, the instructor and the assistants will not answer any questions from students on the day of an examination. Exam results will be announced on the notice boards as soon as the exam papers have been evaluated. Descriptions of these examinations are as follows:

Quizzes: There will be three quizzes that will be announced in advance. They will be of closed-book/closed-notes type but all required material will be supplied.

Midterm Exam: There will be one open-book/open-notes midterm examination that covers all the material up to the date of the examination. The midterm exam may consist of two sections: discussion questions and problems. It will be scheduled for a day in the designated mid-term exams week.

Final Exam: The final examination will be an open-book exam which will cover all the material studied throughout the semester and has the same structure as in the midterm examination. It will also be used to determine letter grades. Like the midterm exam, the final exam will be scheduled for a day in the designated final exams week.

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 (at the end of the semester) to students who missed the **final or midterm exam** and provided adequate documentations for the reason for their absence within three 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 of a physician from the Health Center of the EMU.

Term Project: Students should form groups of **3/4 students** (exactly, otherwise you should submit a valid excuse in written form) who may be in different class groups, should submit a single project report. The topic for the project will be selected by the project group among the list of topics provided by the instructor. Unfortunately, a penalty for late submissions will be applied if the project report is not submitted on the due date.

Note: The students need a calculator so they should bring their calculators to all lecture/tutorial/lab/exam hours.

RELATIONSHIP WITH OTHER COURSES

It is a synthesis course of all the previously taken departmental courses and also a preparation for the graduation project course (IENG492 Manufacturing and Service Systems Design).

LEARNING / TEACHING METHOD

Teaching will be based on enabling the students to understand the concepts and procedures in each topic section and to be able to apply them. To do this the course will be organized into two modules: Lectures and Tutorials/Laboratory sessions. Sometimes four hours of class in a week will be used for lectures according to the perceived need. On the other hand, sometimes 2 hours of class in a week will be organized for lectures, 1 or 2 hours for Tutorials and/or Laboratory sessions.

Lectures: In lectures the instructor will attempt to summarize and explain only selected important concepts and points as clearly as possible. To be familiar with the material presented in lectures and participate in class discussions, students are expected to read the material covered in the previous lectures prior to the class meeting. Students will then find the lectures more interesting, and will benefit from the discussion if they come well prepared.

Tutorials: In addition to the regular lectures, there will be tutorial sessions conducted in the classroom by the assistants, according to the perceived need. In these hours the assistants will do extra example problems. Obviously, the best tutorials are those that meet the learning needs of students. The people who best understand your learning needs are you. Please contact the assistants regarding what you would like to see in the tutorials. Tutorial content will then be determined, and the tutorial date will be announced accordingly.

Laboratory Work: Throughout the semester, there will be several laboratory sessions, which will be conducted by the assistants, to do various computer exercises that require the use of Word, Excel, together with general IE/OR Software available in the laboratory. Laboratory sessions will always be held in the Department's PC Labs and their dates announced in advance. If you have any problem in these sessions please try to resolve your problem with the assistants first.

Office Hours: The students' timetables will be a base for determining appropriate time slots with zero clash (or minimum number of clashes) as much as possible. If students have difficulty in understanding any material after they have tried their best, they should consult their assistants and instructor during their office hours only. However, if you wish to meet the instructor outside of their office hours, please call him by phone or send an e-mail first to make an appointment.

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.

Participation	5%
Homeworks	10 %
Project Study	25 %
Quizzes	15 %
Mid-term Exam	20 %
Final Exam	25 %
TOTAL	100 points

Note 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.

NG (Nil-grade): Conditions that lead to NG (Nil-grade):

1. Not attending the **Final Exam** or its **Make-up Exam** **without a valid excuse**.
2. Not attending the **Mid-term Exam** **without a valid excuse**.
3. Not submitting the **Term Project**.
4. Not attending the **Project Presentation.**
5. Not attending any one of the **Lab Exams** **without a valid excuse**.
6. **Having an attendance to lectures/tutorials/labs less than 70%.**

Objections: Any form of document concerning work that is to be used by the instructor as the basis of grading will be shown to the student upon request, **within a week following the announcement of the grade**. The objection to any grade must be made to the assistants within that period. If, after an exam has been graded, you think an error was made in grading or you have questions about the grading of the material, please examine the exam solutions first, and then write your questions or comments on a separate sheet of paper and turn this paper to the assistants.

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 have the following textbook:

- J. A. Tompkins, J. A. White, Y.A. Bozer, and J. M. A. Tanchoco, "Facilities Planning", 4th ed., John Wiley & Sons, Inc., (2010). ISBN 978-0470444047.

Lecture Notes: Students are expected to make their own notes. Lecture notes and/or overheads used in class will not be made available for copying. Material presented in class taken from other than the textbook will be made available on the web page of the course (refer to http://www.ie.emu.edu.tr).

INDICATIVE BASIC READING LIST

- A. Garcia-Diaz and J.M. Smith, "Facilities Planning and Design", Pearson International Edition, Pearson Education, Inc. (2008). ISBN 0-13-235043-2,
- D.R. Sule, "Manufacturing Facilities: Location, Planning and Design", 2nd ed., PWS Publishing Company, (1994). ISBN 0-53493-435-8,
- Sunderesh Heragu, "Facilities Design", PWS Publishing Company, (1994). ISBN 0-53495-183-X,
- R.G. Askin and C. R. Standridge, "Modeling and Analysis of Manufacturing Systems", John Wiley & Sons, Inc., (1993). ISBN 0-471-51418-7,
- R.L. Francis and J. A. White, "Facility Layout and Location: An analytical approach", Prentice Hall, Inc., (1974). ISBN 0-13-299149-7.

EXTENDED READING LIST

Note that aside from these books, EMU Library has quite a good collection of books on the intermediate and advanced levels in the related fields of industrial engineering discipline.

TOPICS COVERED and COURSE SCHEDULE

WEEK	TOPICS
1	Introduction to Facilities Planning
2	Facility Location Problem
3	Basic Discrete and Continuous Location Models
4	Advanced Location Models
5	Advanced Location & Allocation Models
6	Forecasting and Capacity Determination
7	Defining Requirements (product and process design)
8	Defining Requirements (schedule design)
9	**MIDTERM EXAM WEEK**
10	Flow and Space Planning
11	Introduction to design: Personnel Requirements
12	Materials Handling, Warehousing and Manufacturing Operations
13	Introduction to Plant Layout & Computerized Layout Techniques
14	Facilities Systems
15	**FINAL EXAM WEEKS**
16	Preparing and Presenting, Implementing and Maintaining

Class Schedule	Tutorial Schedule	Laboratory Schedule	Presentation
4 hours of lecture per week by the instructor	1 hour of tutorial per week by the course assistant	2 hours lab at the end of semester for plant layout software	20 minutes for each group at the end of the semester

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!!!