EASTERN MEDITERRANEAN UNIVERSITY
Department of Industrial Engineering
IENG/MANE-461 Systems Modeling and Simulation
COURSE OUTLINE

COURSE CODE	*MANE461*	**COURSE LEVEL**	Fourth year	
COURSE TITLE	Systems Modeling and Simulation	**COURSE TYPE**	Area Core	
CREDIT VALUE	(4, 1, 0) 4	**ECTS VALUE**	6	
PREREQUISITES	MATH322	**COREQUISITES**	MANE385	
DURATION OF COURSE	One semester	**Semester and year**	**Spring**	**2023 - 2024**

WEB LINK	http://staff.emu.edu.tr/adhammackieh/en/teaching/ieng461-mane461			
	Name (group)	**e-mail**	**Office**	**Telephone**
Instructors	Assoc. Prof. Dr. Adham MAKKIE	adham.mackieh@emu.edu.tr	A-104	2813
Assistant(s)	Behzad SANAEI	behzad.sanaei@emu.edu.tr	C-207	1055

CATALOGUE DESCRIPTION

The aim of this course is to give the students a decision tool in order to design and analyze complicated real-life systems for which there is no well-formulated solution. Emphasis is primarily on applications in the areas of production management through the analysis of respective computer simulation models. Use and misuse of simulation as a decision tool. Simulation methodology and model building. Modeling with a simulation language. Random Variate generation. Basis issues in the design. Verification and validation of computer simulation models. Statistical analysis of simulation output data. Use of simulation for estimation and comparison of alternatives.

AIMS & OBJECTIVES

The aim of this course is to give the students a decision tool in order to design and analyze complicated real-life systems for which there is no well-formulated solution.

Course objectives (CO):

1. Discrete Event Simulation Modeling (Manual simulation) [Contributing Student Outcomes 1, 2, 4],
2. Event-Scheduling/Time-Advance Algorithm [Contributing Student Outcomes 1, 2, 4],
3. Using ARENA as a simulation software [Contributing Student Outcomes 1, 2, 4, 6, 7].
4. Designing the simulation experiment [Contributing Student Outcomes 1, 2, 4, 6],
5. Input process modeling [Contributing Student Outcomes 1, 2, 6],
6. Random number generation [Contributing Student Outcomes 1, 6],
7. Random variate generation [Contributing Student Outcomes 1],
8. Verifying and validating simulation models [Contributing Student Outcomes 1, 2, 3, 4, 6],
9. Output analysis (How to make analysis of the simulation output and how to make a decision) [Contributing Student Outcomes 1, 2, 4, 6],
10. Preparing a Term Project (Working effectively in multidisciplinary teams, making an independent research, applying related techniques in real life environment, and writing and presenting a technical report on the results) [Contributing Student Outcomes 1, 2, 3, 4, 5, 6, 7].

GENERAL LEARNING OUTCOMES (COMPETENCES)

On successful completion of this course, all students will have developed **knowledge** and **understanding** of:

- Classification of systems and models, and the simulation models,
- When to use Simulation in Decision Making,
- Discrete-Event Simulation and the Event-Scheduling/Time-Advance Algorithm,
- ARENA as a simulation software package,
- Developing simulation models, random number and variate generation,
- Verification and validation of simulation models,
- Experimental design, data collection and statistical inference making,
- Comparing alternative system designs,
- Importance of assumptions in model building, identifying relevant data, and impact of computer technology in simulation studies.

On successful completion of this course, all students will have developed **their skills in**:

- Developing a Discrete-Event Simulation model.
- Using ARENA software package, and Excel software.
- Relevant data collection.
- Input modeling.
- Building the simulation models.

- Verification of the simulation models.
- Validation of the simulation models.
- Running the simulation experiment and collecting output data.
- Output analysis.
- Statistical inference making.
- Decision-making.
- Effective team work presentation of the simulation project study (written and oral).
- Identifying limitations and realistic constraints on environmental, social and ethical issues.

On successful completion of this course, all students will have developed their **appreciation** of, and respect for **values and attitudes** to:

- Simulation studies as decision-making tools.
- Importance of collecting relevant data in Simulation studies.
- Importance of assumptions in building the simulation model.
- Impact of simulation technology in simulation projects.
- Teamwork.
- Social and ethical issues.
- Continuous learning.

LEARNING TEACHING METHODS

The function of teaching is to enable students to learn. Therefore students are required to read the chapters of the textbook/lecture notes before coming to class and solve the related assignment questions after each lecture. The instructor will lecture in class by writing on the board and by using data projectors.

ASSIGNMENTS

Students will be given a project that should be done in an existing firm or organization and prepared according to the project guidelines. Project presentations will take place after submission of the project. Late submissions will be penalized by 50 percent per day.

METHOD OF ASSESSMENT

All Examinations will be based on lectures, discussions, textbook and assigned work. To enter a formal examination, a student has to present her/his EMU student Identification card to the invigilator.

Quizzes: There will be **four** quizzes designed to test familiarity and basic understanding of various topics. There will be no quiz make-ups.

Midterm Exam: The midterm exam will be held in the week designated by the university administration. It will cover all of the material up to the date of examination.
Final Exam: The final exam will cover the whole course material. In form, it will be a longer version of the midterm exam.

Make-up Exams: Make-up examinations will only be offered to students who provided adequate documentation for the reason of their absence within four working days at the latest after the examination date. One final exam type make-up exam will be offered after the final exams for the missed midterm and/or final exam. University regulations apply for graduation make-ups.

Any objection to the grade or mark should be made latest within a week following its announcement.

Grading Policy:

Lab Quiz	10 %
3 Quizzes	15 %
Midterm Exam	25 %
Term Project-Presentation	10 %
Term Project-Report	15 %
Final Exam	25 %

Note that the instructor reserves the right to modify these percentages in case it is found necessary. Moreover, the student's overall Letter grade will be based on the general assessment of the instructor.

ATTENDANCE

Attendance will be taken every lecture hour. Note that university regulations allow instructors to give a grade of **NG** (Nil Grade) to a student whose absenteeism is more than 30% of the lecture hours and/or who do not complete sufficient work that are included in the assessment of the course. Additionally, The students should attend all lab sessions otherwise, the student may fail in the project work.

TEXTBOOK/S

J. Banks, J.S. Carson II, B.L. Nelson, D.M. Nicol, Discrete-Event System Simulation, Prentice Hall.

COURSE CONTENT AND SCHEDULE

	Lecture Hall	Time
Monday	IE-D101	14:30-16:20
Thursday	IE-D101	10:30-12:20
Friday	PCLAB-I	08:30-10:20 (Lab)
Office Hour	Monday 11:30-12:20 and Thursday: 09:30-10:20	

Week	Topics
1	**Introduction to Systems Modelling and Simulation**
2	**Simulation Examples**
3	**General Principles of Discrete-Event Simulation**
4	**Event-Scheduling/Time-Advance Algorithm**
5	**Overview of Statistical and Queueing Models in Simulation**
6	**Experimental Design and General Review of Statistics and Hypotheses Testing**
7	**Random Number generation and Random Variate Generation**
8	MIDTERM Exams Week
9	**Random Variate Generation**
10	**Random Variate Generation**
11	**Verification and Validation**
12	**Input Modelling**
13	**Output Analysis (Terminating and Non-Terminating)**
14	**Applications on Simulation of Material-Handling Systems & Review**
15-16	Final Exams Week

Contribution of the Course to meeting the requirements of Criterion 5

Mathematics and Basic Sciences: 1 credit hour
Engineering Design : 3 credit hours
General Education : -

Relationship of Course to Program Outcomes

Student Outcomes	Level of Contribution		
	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	☑	☐	☐

ACADEMIC HONESTY – PLAGIARISM

Cheating is copying from others or providing information, written or oral, to others. Plagiarism is copying without acknowledgement from other people's work. According to university by laws cheating and plagiarism are serious offences punishable with disciplinary action ranging from simple failure from the exam or project, to more serious action (letter of official warning suspension from the University for up to One Semester). Disciplinary action is written in student records and may appear in student transcripts.

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