# Philadelphia University

Faculty of Engineering and Technology,
Department of Mechatronics Engineering.
Course Syllabus

## Course Details:

**Title:** Modeling and Simulation (0640327).

**Prerequisite:** Dynamics and Vibrations(640233)+Engineering Analysis(1) (650260).

**Credit Hours:** 3-credit hours (16 weeks per semester, approximately 45 contact hours).

**Textbook:** *"System Dynamics"*, Katsuhiko Ogata, 4th Edition, Pearson Prentice Hall, 2004.

**References:** "*Modeling and Analysis of Dynamic Systems*", Ramin S. Esfandiari, Bei Lu-3rd Edition-CRC Press, 2018
"*System Dynamics*", Palm III, William, 2nd Edition, McGraw-Hill Science, 2009.

**Description:** Modeling definition. Modeling of different physical systems (mechanical, fluid, thermal and electrical). Differential and Laplace equations. State-space representation. Computer simulation techniques (applications using MATLAB Program). System response and analysis.

**Website:** **http://www.philadelphia.edu.jo/academics/malkhawaldeh/**

**Instructor:** Dr. Mustafa Awwad Al-Khawaldeh
**Email**: malkhawaldeh@philadelphia.edu.jo
**Office**: Engineering building, room 6407. Ext.: 2304
**Office hours**: Sunday, Tuesday: 11:15-12:45

## Course Outlines:

| Week | Topic | Assignments |
|---|---|---|
| 1 | Introduction to system dynamics | |
| 2 | The Laplace Transform, Inverse Laplace Transformation | |
| 3 | Solving Linear, Time-Invariant Differential Equations | |
| 4 | Modeling of Mechanical Systems: Introduction to Mechanical Elements | |
| 5 | Rotational motion, Translational-rotational motion. | **Homework** .1 |
| 6 | Modeling of Electrical Systems. | |
| 7 | Mathematical Modeling of Electromechanical Systems, D.C. servomotors | |
| 8 | Mathematical Modeling of Operational-Amplifier Systems | |
| 9 | Mechanical-Electrical Analogies | |
| 10 | Mathematical Modeling of Liquid-Level Systems | **Homework**.2 |
| 11 | Modeling of Pneumatic Systems | |
| 12 | Modeling of Thermal Systems | |
| 13 | Linearization of Nonlinear Systems | |
| 14 | State-Space Approach to Modeling Dynamic Systems | |
| 15 | Time-Domain Analysis of Dynamic Systems Using MATLAB | |
| 16 | Transient-Response Analysis of Second-Order Systems Using MATLAB | |

**Course Learning Outcomes with reference to ABET Student Outcomes:**

Upon successful completion of this course, student should:

| | | |
|---|---|---|
| **1.** | Understand fundamentals of system dynamics. | [1] |
| **2.** | Study the Laplace, inverse Laplace transformation. | [1] |
| **3.** | Obtain a mathematical Model of different physical systems (mechanical, fluid, thermal and electrical). | [1] |
| **4.** | Analyze the transient-response of second-order systems applying MATLAB. | [6] |
| **5.** | Study new technologies in modeling mechatronics systems. | [7] |

**Assessment Guidance:**

Evaluation of the student performance during the semester (total final mark) will be conducted according to the following activities:

**Midterm Exams:** The students will be subjected to mid-term scheduled written exams. The exam covers materials given in lectures in the previous1-7 weeks.

**Quizzes :** Two quizzes will be given during the semester.

**Homework:** Tutorials sheets will be handed out to the students and homework should be solved individually and submitted before or on a set due date.

**Final Exam:** The students will undergo a scheduled final exam at the end of the semester covering the whole materials taught in the course.

**Grading policy:**

| | |
|---|---|
| Mid-Term Exam | 30% |
| Assignments and Homework | 30% |
| Final Exam | 40% |
| Total: | 100% |

**Attendance policy:**

The semester has in total 45 credit hours. Total absence hours from classes and tutorials must not exceed 15% of the total credit hours. Exceeding this limit without a medical or emergency excuse approved by the deanship will prohibit the student from sitting the final exam and a zero mark will be recorded for the course.