

Faculty of Engineering & Technology

Modeling and Simulation

Information :

Course Code : MAN 380

Level : Undergraduate

Course Hours : 2.00- Hours

Department : Department of Mechanical Engineering

Instructor Information :

Title	Name	Office hours
Professor	Hassan Ahmed Ahmed Mohamed Metered	2
Professor	Hassan Ahmed Ahmed Mohamed Metered	2
Assistant Lecturer	Rana Mohamed Abdel Rahman Saleh	4
Assistant Lecturer	Rana Mohamed Abdel Rahman Saleh	4

Area Of Study :

This course aims to:

Enrich the student's basic theoretical knowledge about the modeling of physical systems and their governing differential equations.

Description :

Mathematical models for mechanical, pneumatic, electrical, hydraulic, and mechatronic systems in the time domain for single and multivariable systems; Laplace and state space formulation Continuous, discrete, and combined system models; Hardware-in-the-loop simulation and rapid prototyping of real-time electromechanical systems; Mat Lab, SimMechanics, Simulink, etc. are used to build models and virtual prototypes.

Course outcomes :

a. Knowledge and Understanding: :

1 -	Identify the type control system.
2 -	Identify the type of physical system; mechanical, electrical, hydraulic, pneumatic, electric and electronic.
3 -	Predict time response of first and second order differential equations.

b. Intellectual Skills: :

1 -	Deduce the differential equations of physical systems
2 -	Apply Laplace transformation to change functions from time domain to s-domain and vice versa.
3 -	Transform differential equations to transfer function.
4 -	Solve the differential equations of physical systems.

c. Professional and Practical Skills: :

1 -	Use of MATLAB software to get inverse Laplace transform for certain transfer function.
2 -	Solve first and second order transfer functions using SIMULINK.

d.General and Transferable Skills: :

1 -	Work coherently and successfully as a part of a team in assignments.
2 -	Write reports in accordance with the standard scientific guidelines.

Course Topic And Contents :

Topic	No. of hours	Lecture	Tutorial / Practical
Introduction to control systems	1	1	
Classification of physical systems	2	2	
Modeling of mechanical systems: linear and rotational	6	4	2
Modeling of hydraulic systems	6	4	2
Modeling of pneumatic systems	3	2	1
Modeling of electrical systems	2	4	2
Modeling of electronic systems: Operational amplifiers	5	3	2
Laplace Transform : definition, transformation of various functions from time domain to s-domain	5	4	1
Inverse Laplace Transform and partial fraction method. The use of MATLAB software.	8	4	4
Solution of first and second order differential equations using Laplace transform and transfer function approach. Use of SIMULINK software	3	2	1

Teaching And Learning Methodologies :

Interactive Lecturing
Problem solving
Experiential learning

Course Assessment :

Methods of assessment	Relative weight %	Week No	Assess What
1st Midterm	20.00	6	
2nd Midterm	20.00	11	
Assignments, Participation	10.00		
Final Exam	40.00	16	
Quizzes	10.00		

Recommended books :

Ogata, K., "Modern Control Engineering", Prentice Hall Int., Fourth Edition 2002.
 Bolton, W; "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", Pearson; 6 edition, 2016.