

Zarqa University

Faculty of Engineering Technology
Department: Energy Engineering
Course title:
Simulation and Prediction



Prerequisite: Wind energy
Instructor: TBD
Lecture's time: TBD
Semester: TBD
Office Hours: TBD

Course description:

Principles of prediction and simulation, random number generators, basic probability distributions, Monte Carlo method for simulation, Simulation models of energy systems. Simulation languages.

Aims of the course:

1. Define and analyze a Linear Systems.
2. Examine, and define the principles of simulations, Prediction, and Modelling.
3. Use LabVIEW Simulation to simulate various applications.
4. Create mathematical models for 1st and 2nd orders of Linear Difference Equations.
5. Use LabVIEW to simulate Linear Difference Equations.
6. Study the internal architectures of PIC18 timers and counters.
7. Study the principle of prediction and Random generators.
8. Use Stack shift register in LabVIEW to simulate Linear Congruential Generators (LCG).
9. Study the principle of Monte-Carlo Simulation and use LabVIEW to do the simulation processes.
10. Apply LabVIEW to simulate models of energy systems.

Intended Learning Outcomes (ILOs):

1. Gain a solid understanding of various linear systems.
2. Get comprehensive knowledge on LabVIEW.
3. Apply LabVIEW in mathematics related to statistics, and probabilities.
4. Study prediction and use LabVIEW to simulate random generators like LCG.
5. Learn Monte-Carlo simulation and use LabVIEW in simulating that great prediction tool.
6. Apply LabVIEW in simulating models of energy systems.

Course structures:

Day	Credit Hour	ILOs	Topic(s)	Teaching Procedure	Learning Activities	Learning Platform
21/02/2021	1	0	Course Syllabus discussion	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
23/02/2021	1	1	System Definition	Lecture Preparation	Discussion, and Problem Solving.	Teams & Moodle
25/02/2021	1	1	Principles of Simulation, Identification and Modelling	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
28/02/2021	1	1	Case Study: Falling Ball Modelling and Simulation	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
02/03/2021	1	2	Introduction to LabVIEW Software	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
04/03/2021	1	2	LabVIEW First Example: Celsius to Fahrenheit and Vice Versa	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
07/03/2021	1	1 & 2	LabVIEW 2 nd Example: Buffer Tank of Exponential Function	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
09/03/2021	1	3	Linear and Homogenous Difference Equations: First Order	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
11/03/2021	1	3	Linear and Non-homogenous Difference Equations: First Order	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
14/03/2021	1	3	Use LabVIEW to Simulate Linear Difference Equations of First Order	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
16/03/2021	1	3	Linear and Homogenous Difference Equations: 2 nd Order	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
18/03/2021	1	3	Use LabVIEW to Simulate Linear and Homogenous Difference	Interactive lectures, using	Discussion, and Problem	Teams & Moodle



			Equations of 2 nd Order	PDF Docs, and digital pen	Solving.	
21/03/2021	1	3	Linear and Non-homogenous Difference Equations: 2 nd Order (Part One)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
23/03/2021	1	3	Linear and Non-homogenous Difference Equations: 2 nd Order (Part Two)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
25/03/2021	1	3	Use LabVIEW to Simulate Linear and Non-homogenous Difference Equations of 2 nd Order	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
28/03/2021	1	2	for and while loops in LabVIEW	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
30/03/2021	1	2	Use LabVIEW to generate Sine Function Using only for loop with conditional terminally	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
01/04/2021	1	2	Use LabVIEW to generate Sine Function Using for and while loops with timer & waveform chart	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
04/04/2021	1	4	Fundamental of Prediction, Measures Value, and Calculated Value	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
06/04/2021	1	2 & 3	Use Formula and Formula Node of LabVIEW to Simulate 1 st and 2 nd orders	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
08/04/2021	1	2 & 3	First and Second Order Linear Difference Equation Simulation Using Math Formula Block, Timer, Waveform Graph and Waveform Chart	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
11/04/2021	-----	-----	-----	-----	-----	-----
13/04/2021	1	4	Random Number Generators, and Modular Arithmetic	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
15/04/2021	1	4	Linear Congruential Generators (LCG)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
18/04/2021	1	2, 3, & 4	LabVIEW for Simulating Simple Linear Congruential Generators	Interactive lectures, using PDF Docs,	Discussion, and Problem Solving.	Teams & Moodle



			(LCG)	and digital pen		
20/04/2021	1	2, 3, & 4	LabVIEW for Simulating Complex Linear Congruential Generators (LCG) (Part One)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
22/04/2021	1	2, 3, & 4	LabVIEW for Simulating Complex Linear Congruential Generators (LCG) (Part Two)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
25/04/2021	1		Mid-Term Exam			Moodle
27/04/2021	1	2	Simple and Stack Shift Registers	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
29/04/2021	1	2, 3, & 4	LabVIEW for Simulating LCG Using Simple Shift Register, and Formula Node	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
02/05/2021	1	2, 3, & 4	LabVIEW for Simulating LCG Using Stack Shift Register, and Formula Node	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
04/05/2021	1	2, 3, & 4	First Order Linear Difference Equation Simulation Using Formula Node, and Shift Register	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
06/05/2021	1	2, 3, & 4	Second Order Linear Difference Equation Simulation Using Formula Node, and Shift Register	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
09/05/2021	1	2, 3, & 4	Statistics and Measures of Central Tendency: Mean, Median, Mode, Variance and Standard Deviation	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
11/05/2021	1	2, 3, & 4	Case Study: LabVIEW for Simulation Variance and Standard Deviation	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
13/05/2021	-----	-----	-----	-----	-----	-----
16/05/2021	-----	-----	-----	-----	-----	-----
18/05/2021	1	2, 3, & 4	Discrete Probability Distribution: Binomial, and Poison	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
20/05/2021	1	62, 3, & 4	Continuous Probability Distribution: Uniform, Normal, and Exponential	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
23/05/2021	1	5	Principles of Monte Carlo Simulation	Interactive lectures, using PDF Docs,	Discussion, and Problem Solving.	Teams & Moodle



				and digital pen		
25/05/2021	-----	-----	-----	-----	-----	-----
27/05/2021	1	5	Case Study: LabVIEW for Monte Carlo Simulation (Part One)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
30/05/2021	1	5	Case Study: LabVIEW for Monte Carlo Simulation (Part Two)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
01/06/2021	1	6	Simulation models of energy systems (Part One)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
03/06/2021	1	6	Simulation models of energy systems (Part Two)	Interactive lectures, using PDF Docs, and digital pen	Discussion, and Problem Solving.	Teams & Moodle
	1		Final Exam	50% Marks		Moodle
Total			46 - Lectures			

Textbook:

Textbook: “Modeling, Programming and Simulations Using LabVIEW™ Software”, Pascal Cantot, Dominique Luzeaux, John Wiley, March 2013.
Supplementary Textbook/ Material(s): https://www.ni.com/pdf/manuals/371013a.pdf
Equipment: Internet Connection, Laptops, and Webcams

Assessment Methods:

Method	Grade	Date	Platform	Assignment
Midterm Exam	%35	Fixed by the Department	Moodle	
Participation, Presentation, Attendance...etc	%15	During Semester	Moodle	
Final Exam	%50	Fixed by the Department	Moodle	

