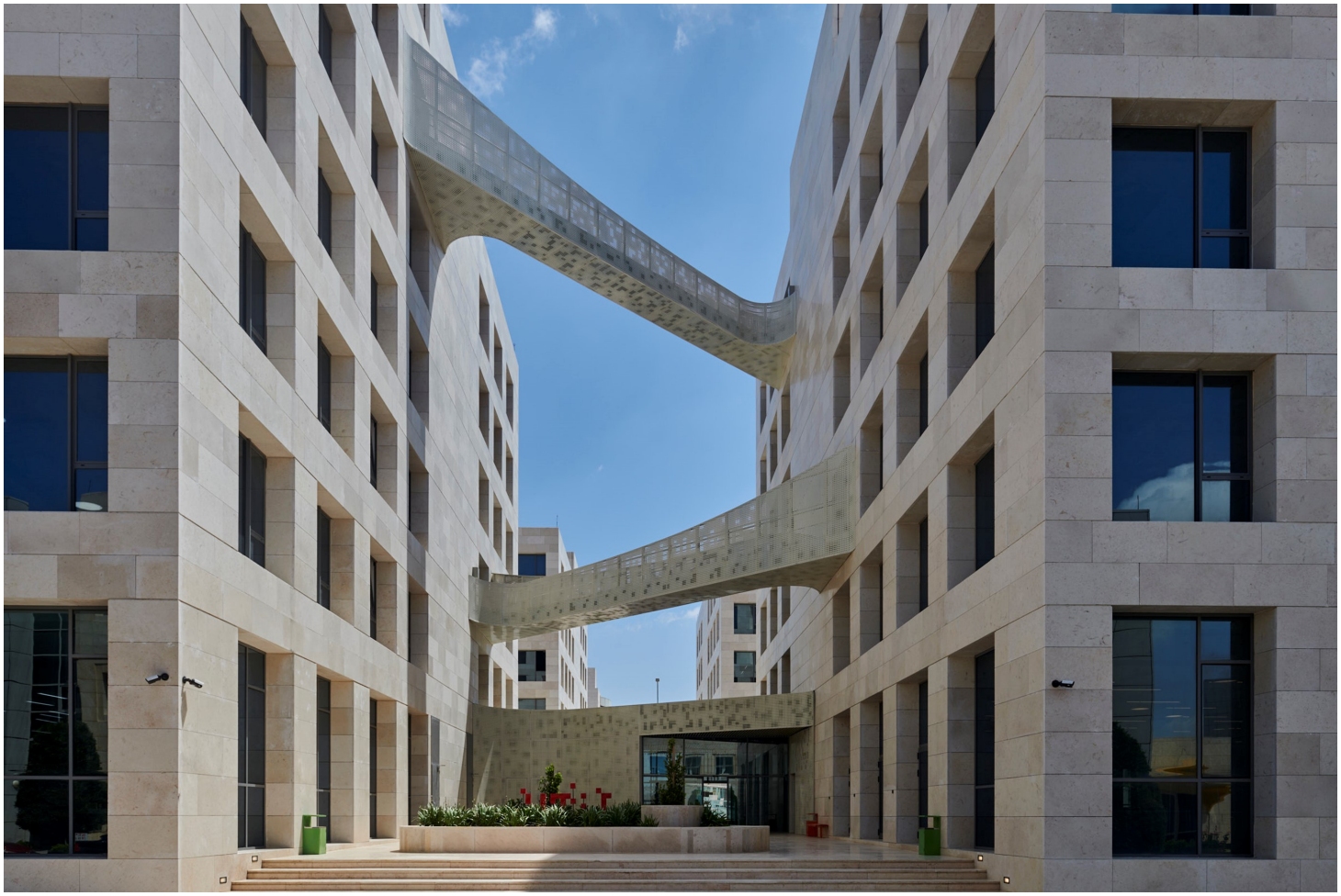
جامعة الحسين التقنية
Al Hussein Technical University

ASSIGNMENT BRIEF

HTU Course No: 10204330	**HTU Course Name:** Modeling and Simulation
BTEC Unit Code:	**BTEC UNIT Name:**



Student Name/ID Number/Section	
HTU Course Number and Title	10204330 Modeling and Simulation
BTEC Unit Code and Title	
Academic Year	2024-2025 1
Assignment Author	Murad Yaghi
Course Tutor	Murad Yaghi
Assignment Title	Applications of Modeling and Simualtion
Assignment Ref No	1
Issue Date	01/12/2024
Formative Assessment dates	From 01/12/2024 to 05/01/2025
Submission Date	29/01/2025
IV Name & Date	Nayef Abu-Aqeel 30/11/2024

Submission Format

The assignment consists of 2 parts, a take-home assignment, and an in-class assignment.

Submission for part 1 of the assignment is expected to be as follows:

1. The submission of a report in the form of a **Docx** soft copy submitted to the university's eLearning system as well as ipynb for Python code.
2. Written in a formal business style according to the given format.
4. Your research should be referenced using the IEEE referencing system.
5. All the results and figures generated in Python (ipynb file) should be copied to the Docx report file with in-detail comments and analysis for the appropriate part.

Submission for part 2 of the assignment is expected to be as follows:

1. The submission of an in-class assignment that would be given at the specified date
2. Declaration Form

eLearning Submission Checklist:

o No compressed files or folders (no.zip or .tar extensions)

o Report file named as "FirstName LastName MS part 1 Fall 24.docx".

o Notebook named as "FirstName LastName MS part 1 notebook Fall 24.ipynb"

o Declaration form

Unit Learning Outcomes

LO1 Introduction and Basic Principles of Modeling and Simulation.

LO2 Modeling and Simulation of Continuous First and Second Order Systems.

LO3 Application of Mathematical and Analytical Techniques for Modeling and Simulation.

LO4 Advanced Data-Driven Techniques for Modeling and Simulation.

Assignment Brief and Guidance

Scenario: You are working as a research and development scientist in one of the specialized leading companies in the field of marine navigation. Your role involves creating models and simulations to predict important parameters such as weave height essential for safe navigation or the ships. Your supervisor asked you to perform the following tasks:

Task 1:

1. Describe a specific problem suitable for applying modeling and simulation.
2. Investigate the importance and benefits of applying modeling and simulation techniques to a specific problem.
3. Investigate the previous methods and work done to solve a specific problem.
4. Design and explain a workflow to solve specific problem based on modeling and simulation.

Task 2:

1. Describe and analyze the data used to model and simulate a specific system
2. Apply a simple standard modeling solution for a specific problem using an appropriate programming language.
3. Plot and evaluate the accuracy of the standard model.
4. Describe and investigate the set of mathematical equations used to describe the model.
5. Explain the theoretical principle of each parameter in the mathematical model and the effect of varying them on the system's behavior.

Task 3:

1. Use different optimization techniques to tune the simulation parameter
2. Design and explain data-driven modeling and simulation techniques for solving a specific problem
3. Optimize and analyze the performance of standard modeling techniques using different optimization method

Task 4:

1. Investigate and explain the workflow of different optimization techniques applied to the standard model
2. Critically analyze and compare the performance of the produced models

Learning Outcomes and Assessment Criteria			
Learning Outcome	**Pass**	**Merit**	**Distinction**
LO1 Introduction and Basic Principles of Modeling and Simulation.	**P1** Describe a specific problem suitable for applying modeling and simulation. **P2** Investigate the importance and benefits of applying modeling and simulation techniques to a specific problem.	**M1** Investigate the previous methods and work done to solve a specific problem.	**D1** Design and explain a workflow to solve specific problem based on modeling and simulation.
LO2 Modeling and Simulation of Continuous First and Second Order Systems.	**P3** Apply a simple standard modeling solution for a specific problem using an appropriate programming language **P4** Plot and evaluate the accuracy of the standard model.	**M2** Investigate and explain the workflow of different optimization techniques applied to the standard model.	**D2** Optimize and analyze the performance of standard modeling techniques using different optimization methods.
LO3 Application of Mathematical and Analytical Techniques for Modeling and Simulation.	**P5** Describe and investigate the set of mathematical equations used to describe the model. **P6** Explain the theoretical principle of each parameter in the mathematical model and the effect of varying them on the system's behavior	**M3** Solve basic first-order differential equations analytically using appropriate methods.	**D3** Solve advanced first-order differential equations analytically using appropriate methods. **D4** Solve advanced second-order differential equations analytically using appropriate methods.
LO4 Advanced Data-Driven Techniques for Modeling and Simulation.	**P7** Describe and analyze the data used to model and simulate a specific system. **P8** Use different optimization techniques to tune the simulation parameters.	**M4** Design and explain data-driven modeling and simulation techniques for solving a specific problem.	**D5** Critically analyze and compare the performance of the produced models.