SYE4036: MANUFACTURING SYSTEMS MODELLING AND OPTIMIZATION

New Syllabus Proposal

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Manufacturing Systems Modelling and Optimization

Subject Code
SYE - Systems Engineering
Course Number
4036

Academic Unit
Systems Engineering (SYE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
SEEM4026 Systems Modelling, Optimization and Simulation or
ADSE4036 Manufacturing Systems Modelling and Optimization

Exclusive Courses
Nil

Part II Course Details

Abstract

The aim of this course is to introduce the simulation modelling and optimization techniques of manufacturing systems, and highlight their applications in practice. It includes modelling, design, simulation, verification and validation, planning and optimization.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Outline the usefulness of system modelling and optimization.	10			
2	Apply the mathematical equations for modelling the behaviour of given manufacturing systems.	25	x		
3	Use a range of manual processes to model, simulate and optimize the given systems.	25	x		
4	Use a range of commercial software packages to construct, verify and validate models of the given systems, and compare the performance of the systems.	40	x	x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Large class activities	The large class activities include mainly lectures. Each student needs to conduct a mini-project.	1, 2, 3, 4	39 hours/semester

2	Laboratory Work	The first laboratory is to let students get starting with the System Modelling and Simulation Software. The second laboratory is to let students work with the System Modelling and Simulation Software. The last laboratory is to let students apply the System Modelling and Simulation Software.	1, 2, 3, 4	9 hours/semester

Assessment Tasks / Activities (ATs)

	ATs	**CILO No.**	**Weighting (%)**	**Remarks (e.g. Parameter for GenAI use)**
1	Laboratory Report (100%): Base on laboratory report: i Experimental results (50%) ii Result analysis and discussion (50%) Laboratory reports will be marked according to the requirement described on the lab sheets.	1, 2, 3, 4	30	

2	Mini-project Report (100%): Base on project report and program demonstration i Application of mathematical equations to describe the problem. (20%) ii Construction of the model to describe the problem (20%) iii Demonstration of the constructed model (40%) iv Discussion on the verification and validation of the model (20%). Each mini project work will be given a problem to solve. Each student needs to outline the capability that system modelling and simulation can do. Also, it needs to describe and apply the mathematical equations for modelling the given problem. Then use a commercial software package to construct, verify and validate the built model.	1, 2, 3, 4	20	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Students will be assessed by testing their understanding of the concepts learnt in class, textbooks, and their ability to apply subject related knowledge.

For a student to pass the course, at least 30% of the maximum mark for the examination and course work should be obtained.

Assessment Rubrics (AR)

Assessment Task

Laboratory Report

Criterion

Base on laboratory report:
i Experimental results (50%)
ii Result analysis and discussion (50%)

Laboratory reports will be marked according to the requirement described on the lab sheets.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Mini-project Report

Criterion

Base on project report and program demonstration
i Application of mathematical equations to describe the problem. (20%)
ii Construction of the model to describe the problem (20%)
iii Demonstration of the constructed model (40%)
iv Discussion on the verification and validation of the model (20%).

Each mini project work will be given a problem to solve. Each student needs to outline the capability that system modelling and simulation can do. Also, it needs to describe and apply the mathematical equations for modelling the given problem. Then use a commercial software package to construct, verify and validate the built model.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Examination

Criterion

Students will be assessed by testing their understanding of the concepts learnt in class, textbooks, and their ability to apply subject related knowledge.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Additional Information for AR

Examination will be numerically-marked and grades awarded accordingly.

Part III Other Information

Keyword Syllabus

Statistical models in simulation, queuing models, random number generation, random variate generation, ARENA, entity transfer, steady-state statistical analysis, model verification and validation, comparison of system designs, ranking and selection, simulation-based optimization.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Simulation with Arena, 6th Edition, W. David Kelton, Randail P. Sadowski, David T. Sturrock, 2015.
2	Discrete-Event System Simulation, 5th Edition, Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, 2013.