

SYE6302: DESIGN SCIENCE

Effective Term

Semester B 2025/26

Part I Course Overview

Course Title

Design Science

Subject Code

SYE - Systems Engineering

Course Number

6302

Academic Unit

Systems Engineering (SYE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

P5, P6 - Postgraduate Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

Nil

Precursors

Nil

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course provides a coherent, interdisciplinary account of how design works , and how to do it better. It covers foundational design theories, methods, and principles that transcend conventional disciplinary boundaries. Through a

blend of lectures and hands-on design projects, students will learn how design science intersects with practical applications across diverse fields, including engineering, architecture, medicine, business, policy, and etc. Lectures will introduce a wide range of techniques for empathy, ideation, prototyping, testing, optimization, and etc throughout the design process. Particularly, students will learn to treat AI as both material and partner in design: using generative and agentic systems to widen search and tighten iteration, grounded in verification and governance. Design projects will challenge students to recognize emerging societal issues as design opportunities, leading to the creation of human-centred products, services, and systems that shape the future. By integrating theoretical knowledge with experiential learning, this course helps students develop a holistic understanding of design's transformative power, fostering innovation and leadership.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Acquire design thinking, system thinking, and evolutionary thinking	25	x		
2	Master existing design principles and methods that are applicable across domains and disciplines	25	x	x	
3	Develop abilities to apply design theories, principles and methods effectively in realistic design processes	25	x	x	x
4	Nurture empathy, creativity, entrepreneurship and leadership for human-centered design and innovation	25	x	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.

Learning and Teaching Activities (LTAs)

LTAs	Brief Description	CILO No.	Hours/week (if applicable)	
1	Lectures	Weekly lectures to introduce and discuss fundamental concepts	1, 2, 4	1.5 hr / week
2	Team-Based Design Project Studios	Weekly sessions for students to work in teams on their design projects, share progresses, and obtain feedback from peers, TA and the instructor	1, 2, 3, 4	1.5 hr / week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("- for nil entry)	Allow Use of GenAI?
1	Individual Assignment 1: Design Theories and Methods	1, 2	10	-	Yes
2	Individual Assignment 2: Human-Centered Design with Systems Thinking	1, 2	10	-	Yes
3	Team Project Presentation 1: Team Building and Ideation	1, 2, 3, 4	10	-	Yes
4	Team Project Presentation 2: Prototyping	1, 2, 3, 4	20	-	Yes
5	Team Project Presentation 3: Delivering	1, 2, 3, 4	10	-	Yes
6	Team Peer Evaluation	3, 4	10	-	No
7	In-class discussion and activities	1, 4	10	-	Yes

Continuous Assessment (%)

80

Examination (%)

20

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Assessment Rubrics (AR)**Assessment Task**

1. Individual Assignment 1: Design Theories and Methods (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Quality of critical analysis and application of design theories and methods.

Excellent

(A+, A, A-) High

Demonstrates an exceptional understanding of design theories and methods, with deep critical analysis, clear arguments, and original insights.

Good

(B+, B, B-) Significant

Shows a solid grasp of the material, with well-structured arguments and reasonable analysis, though lacking in-depth innovation or originality.

Fair

(C+, C, C-) Moderate

Demonstrates a basic understanding with some analysis but lacks depth and clear connection to design theories.

Marginal

(D) Basic

Shows limited understanding, with minimal analysis and unclear connection to the course material.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate understanding or application of design theories and methods.

Assessment Task

2. Individual Assignment 2: Human-Centered Design with Systems Thinking (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Demonstration of systems thinking and human-centered design principles.

Excellent

(A+, A, A-) High

Demonstrates a strong application of systems thinking and human-centered design, with innovative ideas and well-justified design decisions

Good

(B+, B, B-) Significant

Shows good application of principles with sound reasoning and some innovation.

Fair

(C+, C, C-) Moderate

Provides basic application of design principles but lacks creativity or thoroughness.

Marginal

(D) Basic

Shows minimal application of systems thinking or human-centered design, with limited creativity.

Failure

(F) Not even reaching marginal levels

Fails to apply systems thinking or human-centered design principles.

Assessment Task

3. Team Project Presentation 1: Build Team and Ideate (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Effectiveness of team collaboration and quality of idea generation.

Excellent

(A+, A, A-) High

Demonstrates exceptional teamwork with highly creative and well-developed ideas. Clear roles, responsibilities, and excellent synergy within the team.

Good

(B+, B, B-) Significant

Shows good collaboration with innovative ideas but may lack depth or full team integration.

Fair

(C+, C, C-) Moderate

Basic team effort with some viable ideas but lacking in creativity or cohesiveness.

Marginal

(D) Basic

Weak collaboration with underdeveloped ideas and unclear team roles.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate teamwork or produce viable ideas.

Assessment Task

4. Team Project Presentation 2: Prototype and Test (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Quality and feasibility of prototypes, and thoroughness of testing.

Excellent

(A+, A, A-) High

Produces highly innovative and functional prototypes with thorough testing and well-documented results.

Good

(B+, B, B-) Significant

Demonstrates solid prototyping skills with functional designs and adequate testing, though missing some refinements.

Fair

(C+, C, C-) Moderate

Prototypes are basic, with limited functionality and incomplete testing.

Marginal

(D) Basic

Prototypes are underdeveloped with minimal or flawed testing.

Failure

(F) Not even reaching marginal levels

Fails to produce a functional prototype or conduct meaningful testing.

Assessment Task

5. Team Project Presentation 3: Pitch and Demo (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Clarity and persuasiveness of the pitch, and demonstration of design solutions.

Excellent

(A+, A, A-) High

Delivers a compelling and professional pitch with clear, innovative design solutions that are effectively demonstrated.

Good

(B+, B, B-) Significant

Presents a clear and logical pitch with well-demonstrated solutions, though lacking in full persuasiveness or innovation.

Fair

(C+, C, C-) Moderate

Basic pitch with an understandable solution, but lacks compelling elements or clear demonstration.

Marginal

(D) Basic

Weak pitch with unclear or poorly demonstrated solutions.

Failure

(F) Not even reaching marginal levels

Fails to deliver a coherent pitch or demonstrate the design solution effectively.

Assessment Task

6. Team Peer Evaluation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Contribution to team efforts, collaboration, and peer support.

Excellent

(A+, A, A-) High

Demonstrates outstanding contribution to the team, offering substantial support, leadership, and collaboration throughout.

Good

(B+, B, B-) Significant

Shows strong contribution and effective teamwork, though with room for improvement in collaboration or leadership.

Fair

(C+, C, C-) Moderate

Provides a basic contribution but lacks consistent engagement or impact on the team's success.

Marginal

(D) Basic

Contributes minimally to the team, with noticeable gaps in collaboration and effort.

Failure

(F) Not even reaching marginal levels

Fails to contribute to the team or causes disruptions to team progress.

Assessment Task

7. In-class discussion and activities (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Engagement in class discussions, active contribution to group activities, and demonstration of critical thinking.

Excellent

(A+, A, A-) Actively participates in class discussions with insightful, well-considered contributions. Demonstrates a strong ability to engage with peers and instructors through critical questions, constructive feedback, and leadership in group activities. Consistently shows a deep understanding of course content and applies it meaningfully in discussions.

Good

(B+, B, B-) Regularly participates in class with thoughtful comments and questions. Shows a good understanding of the material and contributes positively to group activities, though with some room for deeper engagement or leadership.

Fair

(C+, C, C-) Participates occasionally in class discussions and group activities. Displays a basic understanding of the material but contributions are limited in depth or frequency.

Marginal

(D) Rarely participates in discussions and group activities. Demonstrates minimal understanding of the course material and lacks engagement with peers or instructors.

Failure

(F) Does not participate in class discussions or group activities. Fails to demonstrate any engagement with the course material or class dynamics.

Assessment Task

1. Individual Assignment 1: Design Theories and Methods (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Quality of critical analysis and application of design theories and methods.

Excellent

(A+, A, A-) High

Demonstrates a comprehensive and nuanced understanding of design theories and methods with deep critical analysis, clear arguments, and original insights.

Good

(B+, B) Significant

Shows a solid grasp of the material with well-structured arguments and reasonable analysis but lacks significant originality or deep innovation.

Marginal

(B-, C+, C) Moderate/Basic

Demonstrates a basic understanding of the material but lacks depth, with only moderate analysis and limited application of design theories.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate an understanding or application of design theories and methods, with minimal or no analysis.

Assessment Task

2. Individual Assignment 2: Human-Centered Design with Systems Thinking (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Demonstration of systems thinking and human-centered design principles.

Excellent

(A+, A, A-) High

Demonstrates a comprehensive and nuanced understanding of design theories and methods with deep critical analysis, clear arguments, and original insights.

Good

(B+, B) Significant

Shows a solid grasp of the material with well-structured arguments and reasonable analysis but lacks significant originality or deep innovation.

Marginal

(B-, C+, C) Moderate/Basic

Demonstrates a basic understanding of the material but lacks depth, with only moderate analysis and limited application of design theories.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate an understanding or application of design theories and methods, with minimal or no analysis.

Assessment Task

3. Team Project Presentation 1: Build Team and Ideate (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Effectiveness of team collaboration and quality of idea generation.

Excellent

(A+, A, A-) High

Demonstrates a comprehensive and nuanced understanding of design theories and methods with deep critical analysis, clear arguments, and original insights.

Good

(B+, B) Significant

Shows a solid grasp of the material with well-structured arguments and reasonable analysis but lacks significant originality or deep innovation.

Marginal

(B-, C+, C) Moderate/Basic

Demonstrates a basic understanding of the material but lacks depth, with only moderate analysis and limited application of design theories.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate an understanding or application of design theories and methods, with minimal or no analysis.

Assessment Task

4. Team Project Presentation 2: Prototype and Test (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Quality and feasibility of prototypes, and thoroughness of testing.

Excellent

(A+, A, A-) High

Demonstrates a comprehensive and nuanced understanding of design theories and methods with deep critical analysis, clear arguments, and original insights.

Good

(B+, B) Significant

Shows a solid grasp of the material with well-structured arguments and reasonable analysis but lacks significant originality or deep innovation.

Marginal

(B-, C+, C) Moderate/Basic

Demonstrates a basic understanding of the material but lacks depth, with only moderate analysis and limited application of design theories.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate an understanding or application of design theories and methods, with minimal or no analysis.

Assessment Task

5. Team Project Presentation 3: Pitch and Demo (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Clarity and persuasiveness of the pitch, and demonstration of design solutions.

Excellent

(A+, A, A-) High

Demonstrates a comprehensive and nuanced understanding of design theories and methods with deep critical analysis, clear arguments, and original insights.

Good

(B+, B) Significant

Shows a solid grasp of the material with well-structured arguments and reasonable analysis but lacks significant originality or deep innovation.

Marginal

(B-, C+, C) Moderate/Basic

Demonstrates a basic understanding of the material but lacks depth, with only moderate analysis and limited application of design theories.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate an understanding or application of design theories and methods, with minimal or no analysis.

Assessment Task

6. Team Peer Evaluation (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Contribution to team efforts, collaboration, and peer support.

Excellent

(A+, A, A-) High

Demonstrates a comprehensive and nuanced understanding of design theories and methods with deep critical analysis, clear arguments, and original insights.

Good

(B+, B) Significant

Shows a solid grasp of the material with well-structured arguments and reasonable analysis but lacks significant originality or deep innovation.

Marginal

(B-, C+, C) Moderate/Basic

Demonstrates a basic understanding of the material but lacks depth, with only moderate analysis and limited application of design theories.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate an understanding or application of design theories and methods, with minimal or no analysis.

Assessment Task

7. In-class discussion and activities (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Engagement in class discussions, active contribution to group activities, and demonstration of critical thinking.

Excellent

(A+, A, A-) High

Demonstrates a comprehensive and nuanced understanding of design theories and methods with deep critical analysis, clear arguments, and original insights.

Good

(B+, B) Significant

Shows a solid grasp of the material with well-structured arguments and reasonable analysis but lacks significant originality or deep innovation.

Marginal

(B-, C+, C) Moderate/Basic

Demonstrates a basic understanding of the material but lacks depth, with only moderate analysis and limited application of design theories.

Failure

(F) Not even reaching marginal levels

Fails to demonstrate an understanding or application of design theories and methods, with minimal or no analysis.

Part III Other Information

Keyword Syllabus

- Design thinking
- Systems thinking
- Creativity
- Innovation
- Emerging technologies
- AI for design

Reading List

Compulsory Readings

Title	
1	Jianxi Luo, "Design Science: Driving Innovation with Unified Principles", Springer, 2026
2	Weekly lecture notes and slides from the instructor

Additional Readings

Title	
1	Design for a Better World: Meaningful, Sustainable, Humanity Centered, Don Norman. The MIT Press, 2023
2	The Singularity Is Near: When Humans Transcend Biology, Ray Kurzweil. Viking, 2005
3	The Sciences of the Artificial, third edition, Herbert A. Simon. The MIT Press, 1996
4	Design Thinking, Tim Brown. Harvard Business Review, 2008