

City University of Hong Kong
Course Syllabus

offered by Department of Electrical Engineering
with effect from Semester B in 2021/2022

Part I Course Overview

Course Title: Complexity in Science and Technology

Course Code: GE2318

Course Duration: One Semester (13 weeks)

Credit Units: 3

Level: B2

Proposed Area: Arts and Humanities
(for GE courses only) Study of Societies, Social and Business Organisations
 Science and Technology

Medium of Instruction: English

Medium of Assessment: English

Prerequisites: Nil
(Course Code and Title)

Precursors: Nil
(Course Code and Title)

Equivalent Courses: Nil
(Course Code and Title)

Exclusive Courses: Nil
(Course Code and Title)

Part II Course Details

1. Abstract

New sciences is not developed at random or from scratch, but instead rooted in knowledge and wisdom. This course is to open up students' mind to welcome the scientific knowledge and wisdom (such as Chaos, Fractals, Networks and Complexity) and to guide the students to witness how these pieces of knowledge were developed and how they can light up the modern sciences, thereby helping them to improve their innovative ideas and cognitive skills. Through the lectures, students will be able to grasp some major concepts of general scientific knowledge and wisdom, and understand some core ideas in a few selected modern scientific fields (specifically, chaos theory, fractals, complex networks, intelligent systems and complexity). Throughout course learning and after-class reading, students will be able to experience the close relationships among the long-lasting scientific knowledge, the rapidly-evolving modern science, and their daily-life activities.

This course aims to enhance the appreciation of close relationship between the fundamental knowledge and the advancements of contemporary science and mathematics, including topics such as chaos, fractals, complex networks and intelligent systems. It also serves as an introductory course in life philosophy that could enrich students' life-long learning and personal development.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs [#]	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	A2	A3
1.	Describe the major concepts of some selected knowledge and wisdom, such as chaos, fractals and nonlinear science.		√	√	
2.	Describe the major concepts in some selected modern scientific topics, such as network science and complexity in modern science and technology.			√	
3.	Identify the relationship between fundamental knowledge and modern sciences			√	
4.	Describe daily-life phenomena from a scientific perspective			√	√
		100%			

* If weighting is assigned to CILOs, they should add up to 100%.

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4			
Lectures	Explain key concepts of the related topics in the course.	√	√	√	√			3 hrs/wk for 13 weeks
Self-learning activities	Possible activities include self-reading and self-study of hand-out materials.	√	√	√	√			N.A.

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4				
Continuous Assessment: 50%								
Test (min: 2)	√	√	√	√			40%	
#Assignments (min: 3)	√	√	√	√			10%	
Examination: 50%								
Examination (duration: 2 hrs)	√	√	√	√			50%	
							100%	

* The weightings should add up to 100%.

Remark:

To pass the course, students are required to achieve at least 30% in the continuous assessment and 30% in the examination.

may include homework, tutorial exercise, project/mini-project, presentation

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
Examination	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels
Coursework	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus:

1. Complex Networks

System complexity, complex networks, human dynamics, social networks

2. Chaos

Background and history, chaotic systems, characteristics, attractors, applications

3. Fractals

Background, similarity, fractal structure, fractal patterns, applications

4. Intelligent systems:

Background, neural networks, robotics, automatic control, intelligent transportation systems

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

1.	Nil
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2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

1.	Texts on Complexity and Complex Networks [A1] Guanrong Chen, Xiaofan Wang, and Xiang Li, “Fundamentals of Complex Networks: Models, Structures and Dynamics,” Singapore: Wiley, 2015. (E book available) [A2] Shlomo Havlin, “Complex Networks: Structure, Robustness and Function,” Cambridge University Press, 2010. [A3] Mark Newman, “Networks: An Introduction,” Oxford University Press, 2010.
2.	Texts on Fractals [B1] Heinz-Otto Peitgen, Hartmut Jürgens, Dietmar Saupe, “Fractals for the Classroom,” Springer-Verlag, 1992.
3.	Online Reading Materials http://www.apophysis.org/tutorials/index.html https://en.wikipedia.org/wiki/Network_science

Annex (For GE courses only)
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- A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

GE PILO	Please indicate which CILO(s) is/are related to this PILO, if any <i>(can be more than one CILOs in each PILO)</i>
PILO 1: Demonstrate the capacity for self-directed learning	The designated self-learning activities are to facilitate students with self-directed learning.
PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology	The CILOs 1 and 2 are closely related to this PILO. The lectures are to facilitate students with this skill.
PILO 3: Demonstrate critical thinking skills	The CILOs 3 and 4 are closely related to this PILO. Students have to demonstrate the skills in the assessment activities.
PILO 4: Interpret information and numerical data	The CILOs 3 and 4 are closely related to this PILO. Students have to collect the information for the self-learning activities. They also have to demonstrate the skills in the assessment activities.
PILO 5: Produce structured, well-organised and fluent text	Students have to demonstrate the skills in the assessment activities.
PILO 6: Demonstrate effective oral communication skills	
PILO 7: Demonstrate an ability to work effectively in a team	
PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues	
PILO 9: Value ethical and socially responsible actions	
PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation	The designated assessment activities are to allow students to apply the knowledge learnt in the course.

GE course leaders should cover the mandatory PILOs for the GE area (Area 1: Arts and Humanities; Area 2: Study of Societies, Social and Business Organisations; Area 3: Science and Technology) for which they have classified their course; for quality assurance purposes, they are advised to carefully consider if it is beneficial to claim any coverage of additional PILOs. General advice would be to restrict PILOs to only the essential ones. (Please refer to the curricular mapping of GE programme: http://www.cityu.edu.hk/edge/ge/faculty/curricular_mapping.htm.)

- B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task
Examination