City University of Hong Kong
Course Syllabus

offered by Department of Electrical Engineering
with effect from Semester B 2019/2020

Part I Course Overview

Course Title:	Complex Networks: Modeling, Dynamics and Control
Course Code:	EE6605
Course Duration:	One Semester (13 weeks)
Credit Units:	3
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	MA3150 Advanced Mathematical Analysis or equivalent
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

The aim of this course is to provide students with a good understanding of basic concepts, techniques and principles of complex networks: their modelling, dynamics and control.

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.	Apply basic concepts to describe representative network models		✓	✓	✓
2.	Analyze the effects of network structures on dynamical behaviors		✓	✓	✓
3.	Estimate local and global network stability, synchronizability and controllability		✓	✓	
4.	Develop small-scale efficient virus-spreading control algorithms		✓	✓	
5.	Describe the control of data traffic flows and network topological effect		✓	✓	
6.	Apply the learned techniques to solve some practical problems			✓	✓
		100%			

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	5	6	
Lecture	Illustrate basic concepts Demonstrate basic properties Show typical applications	✓	✓	✓	✓	✓		3 hrs/ week
Weekly homework	Illustrate basic concepts Demonstrate basic properties Show typical applications	✓	✓	✓	✓	✓		2 hrs/ week
Take-home term project (4 weeks)	Initiate innovative ideas Develop individual designs Perform computer programming						✓	

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	5	6		
Continuous Assessment: 50%								
Tests (min.: 2)	✓	✓	✓	✓	✓	✓	40%	One mid-term test and one project report at an equivalent level with the mid-term test.
#Assignments (min.: 3)	✓	✓	✓	✓	✓		10%	
Examination: 50% (duration: 2hrs , if applicable)								
Examination	✓	✓	✓	✓	✓		50%	
							100%	

Remark:

To pass the course, students are required to achieve at least 30% in course work 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)
1. Examination	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Coursework	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels

6. Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1,2,3,4,5	Lecturing is the core of teaching. Reading materials will be suggested. One homework assignment will be given each week, for week 2 - week7. One large-scale computer project will be assigned for week 8 - week 12 to complete.
6	The take-home project requires self-motivated design and significant computer simulation demonstrating network science knowledge with clear real-world application background and implication. This project is research-oriented, requiring some new ideas and new techniques to complete.

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

1. Keyword Syllabus

Network Structures and Properties
Recent advances in scientific literature including the complexity of models; degree distributions; random graphs; small-world features; scale-free properties; basic network modeling

Elementary Graph Theory
Basic concepts; elementary properties; typical algorithms; graph applications

Network Dynamics
Network dynamical behaviors; stability and synchronization; network game; community structures; opinion dynamics; evolving networks

Network Performances
Internet topology; data traffic; epidemics spreading; cascade failures

Network Synchronization and Control
Network synchronization phenomena and criteria; network stabilization and pinning control; data traffic congestion control; network synchronizability and controllability

Potential Engineering Applications
Internet; power grids; transportation networks; social networks

Research-Oriented Computer project
A self-designed, self-performed and self-analyzed computer-programming project, using basic complex-network knowledge learned from the course

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.	Lecture Notes

2.2 Additional Readings

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

1.	G. R. Chen, X. F. Wang and X. Li, Introduction to Complex Networks: Models, Structures and Dynamics, High Education Press, Beijing, China, January 2015
2.	X. F. Wang, X. Li and G. R. Chen, Network Science: An Introduction (in Chinese), High Education Press, Beijing, China, April 2012