CUHK (SZ)

Course Outline

1. Course Identity

A. Course as listed in CUHK(SZ)

The information in this block should be exactly as approved by CUHK Senate. In case there are any differences, please explain in the table below.

Course code	EIE3280
Course title (English)	Networks: Technology, Economics and Society
Course title (Chinese)	网络: 技术、经济和社会
Units	3
Description (English)	This course introduces various networking technologies that we use each day and the fundamental principles behind them. Different from many "theory-based" networking courses, this course is organized around a list of intriguing questions about the technological, economic and social aspects of modern networks. The course will broadly cover topics on wireless networks, Internet, social networks, and network economics. We will introduce various methodologies such as graph theory, optimization theory, game theory, and pricing theory. The intended audience of this course are undergraduates in Computer Science, Electronic and Information Engineering. It is also suitable for interested undergraduate students from Mathematics and Social Sciences. Students are expected to have taken math courses covering multivariate calculus, linear algebra, and ordinary differential equations, and have some training in programing.
Description (Chinese)	本课程将探讨我们在日常生活中接触的各种网络技术以及其背后的基本原理。与许多纯理论性的网络课程不同，本科将讨论一系列与现代网络相关的技术、经济和社会方面的有趣问题。本科将涵盖以下方面的内容:无线网络、互联网、社交网络和网络经济。我们将介绍各种相关理论，包括图论、优化理论、博弈论、和微观经济学。本科主要是针对计

	算机科学以及电子信息工程方向的本科生。同时亦适合对本科有兴趣的数学和其他社会科学方向的本科生。选课者须曾修读多变量微积分，线性代数以及常微分方程，并有一定的编程基础。

B. <u>Corresponding course in CUHK</u>

Please give details of the *closest* corresponding course in CUHK (as approved by CUHK Senate and listed in course list). If the course in SZ maps to more than one course in CUHK, please make multiple copies of the block below.

Course code	IERG3280
Course title (English)	Networks: Technology, Economics, and Social Interactions
Course title (Chinese)	网络: 技术，经济，和社会互动
Units	3
Description (English)	This course introduces various networking technologies we use each day and the fundamental ideas behind them. Different from many "theory-based" networking courses, this course is organized around a list of intriguing questions about the technological, social, and economical aspects of modern networks. The course will broadly cover topics on wireless networks, Internet, social networks, and network economics. We will introduce various methodologies such as graph theory, optimization theory, game theory, and pricing theory. The intended audience of this course includes undergraduates with majors in Information Engineering, Computer Science and Engineering and Electronic Engineering. It is also suitable for interested undergraduate students from Mathematics, and other Social Science majors. Advisory: Students are expected to have taken Advanced Engineering Math course covering multivariate calculus and linear algebra.
Description (Chinese)	本科将探讨我们在日常生活中接触的各种网络技术以及其背后的基本原理。与许多纯理论性的网络课程不同，本科将讨论一系列与现代网络相关的技术、社会和经济方面的有趣问题。本科将涵盖以下方面的内容:无线网络、互联

	网、社交网络和网络济。我们将介绍各种相关理论，包括图论、优化理论、博弈论、和微观经济学。本科主要是针对信息工程系、计算机科学与工程系以及电子工程系本科生中处于最后两年的学生。同时亦适合对本科有兴趣的数学和其他社会科学主修的本科生。参考意见: 选课者须曾修读高级工程数学课程涵盖之多变量微积分及线性代数。

2. Prerequisites / Co-requisites

Please state prerequisites and co-requisites, in terms of courses in CUHK (SZ)* or any other requirements (e.g., having taken certain subjects in high school).

(* Because course codes may not yet be stable, please provide both course code and course tile.)

A. Prerequisites

MAT1001 Calculus I

MAT1002 Calculus II

STA2001 Probability and Statistics I

MAT2002 Ordinary Differential Equations

B. Co-requisites

N.A.

3. Learning Outcomes

Upon successful completion of the course, the students will acquire the ability to

1. Understand the core concepts and fundamental methodologies of networking;
2. Learn how to model and analyze emerging networking phenomenon;
3. Gain the ability to apply knowledge of mathematics, science, and engineering in the field of networking;

4. Gain the ability to design a system, component or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability;
5. Gain the ability to identify, formulate and solve engineering problems;
6. Gain the ability to understand professional and ethical responsibility;
7. Gain the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice in networking.

4. Course syllabus

This course introduces various networking technologies we use each day and the fundamental ideas behind them. Different from many "theory-based" networking courses, this course is organized around a list of intriguing questions about the technological, social, and economical aspects of modern networks. We will provide "just enough" theory to answer these questions.

Examples of the questions we will answer in this course include:

1. What makes CDMA work for my cell phone?
2. How does Google sell ad spaces?
3. How does Google rank webpages?
4. How does Netflix recommend movies?
5. When can I trust product ratings on Amazon?
6. Why does Wikipedia even work?
7. How can Skype and BitTorrent be free?
8. Twitter and Facebook: How to influence people online?
9. Can I really reach anyone in 6 steps?
10. How can I pay less for my Internet connection?

The list of the questions will be updated over the years to reflect the changes of networking technologies and the interests of the students. The course will broadly cover the following networking topics: Wireless, Internet, Content Distribution, Web, Online Social Networks, and Network Economics. The modeling language and analysis machinery come from fields including Graph Theory, Optimization Theory, Game Theory, Learning Theory, and

Microeconomics. Of course, the students do not need to have knowledge about these fields prior of taking this course.

5. Assessment Scheme

Component/ method	% weight
Class Participation	5%
Assignments	25%
Mid-term quiz	35%
Project	35%

6. Grade Descriptors

Grade A

Demonstrates the ability to synthesize and apply the principles or subject matter learnt in the course, to novel situations and/or in novel ways, in a manner that would surpass the normal expectation at this level, and typical of standards that may be common at higher levels of study or research.

Has the ability to express the synthesis of ideas or application in a clear and cogent manner.

Grade A-

Demonstrates the ability to state and apply the principles or subject matter learnt in the course to familiar and standard situations in a manner that is logical and comprehensive.

Has the ability to express the knowledge or application with clarity.

Grade B

Demonstrates the ability to state and partially apply the principles or subject matter learnt in the course to most (but not all) familiar and standard situations in a manner that is usually logically persuasive.

Has the ability to express the knowledge or application in a satisfactory and unambiguous way.

Grade C

Demonstrates the ability to state and apply the principles or subject matter learnt in the course to most (but not all) familiar and standard situations in a manner that is not incorrect but is somewhat fragmented.

Has the ability to express the separate pieces of knowledge in an unambiguous way.

Grade D

Demonstrates the ability to state and sometimes apply the principles or subject matter learnt in the course to some simple and familiar situations in a manner that is broadly correct in its essentials

Has the ability to state the knowledge or application in simple terms.

Grade F

Unsatisfactory performance on a number of learning outcomes, OR failure to meet specified assessment requirements.

7. Feedback for evaluation

- Course and Teaching Evaluation by students after finishing all the lectures
- Reflections from teachers of more advanced courses
- In-class questions, feedback from informal conversation and e-mail correspondence with students after class

8. Reading

A. Required

M. Chiang, "Networked Life: 20 Questions and Answers", Cambridge University Press, 2012

B. Recommended

D. Easley and J. Kleinberg, "Networks, Crowds, and Markets", Cambridge University Press, 2010

J. Huang and L. Gao, “Wireless Network Pricing”, Synthesis Lectures on Communication Networks, Morgan & Claypool, 2013

9. Course components

Activity	Hours/week
Lecture	6 hours per week
Tutorial	2 hour per week
Self-study	3 hour per week
Homework	4 hours per week
Project	3 hours per week (on average)

10. Indicative teaching plan (for summer 7 weeks of teaching)

Week	Content/ topic/ activity
1	Chapter 1: What makes CDMA work for my SmartPhone? Chapter 2: How does Google sell ad spaces?
2	Chapter 3: How does Google rank webpages? Chapter 4: How does Netflix recommend movies?
3	Chapter 5: When can I trust an average rating on Amazon? Chapter 6: Why does Wikipedia even work?
4	Chapter 7: How do I viralize a YouTube video and tip a Groupon deal? Chapter 8: How do I influence people on Facebook and Twitter?
5	Chapter 9: Can I really reach anyone in six steps? Mid-term Exam (Thursday July 11)
6	Chapter 15: How can Skype and BitTorrent be free? Chapter 18: Why is WiFi faster at home than at a hotspot?
7	Project Presentation

11. Implementation plan (2018–2019)

The implementation plan may vary from year to year. Please indicate expected enrolment, and number of sections.

Summer course of 7 weeks: 50 students for lecture (6 sessions per week), 50 students for tutorials (2 per week)

12. Approval

Has the course title been included in the program submission approved by CUHK Senate? Are there any differences?

Have the details (as in this document) been approved at School or other level in CUHK (SZ)?

13. Any other information

None

14. Version date

Version number	V001
As of (date)	20190208

Please save file as XXXXxxxx v-nnn yymmdd

XXXXxxxx = course code, e.g., MATH1212 nn = version number, e.g., 001 for version 1 yymmdd = date of this version,

e.g., 131210