City University of Hong Kong
Course Syllabus

offered by School of Data Science
with effect from Semester A 2021/22

Part I Course Overview

Course Title:	Data Analytics for Smart Cities
Course Code:	SDSC6004
Course Duration:	One Semester
Credit Units:	3
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

Modern cities depend on data flows that connect users and infrastructure. Thus, data science skills are critical for design and operation of smart cities. The abundance of data, and statistical analysis and machine learning algorithms for utilizing the data are expected to significantly improve decisions about how urban infrastructure and its environment are maintained and built. This course teaches basic, readily applicable data analytics, statistical methods, and machine learning algorithms that are useful for exploiting data obtained via crowd-sensing and remote sensing technologies within transportation, environmental, building, and power grids systems. The course will be taught in four modules: mobility and transportation, building energy systems, extreme events and urban resilience, and climate change and environmental variability. Throughout the course, students will learn to use real data to solve smart city application problems via basic statistics and machine learning techniques.

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.	**Understand** data science principles in the design and operation of smart cities	20%	✓		
2.	**Learn** smart city applications that are revolutionized by the increasing availability of data	20%	✓		
3.	**Apply** the appropriate data science methods to various smart city applications	20%	✓		
4.	**Improve** the design or operation of a smart city by using data analytic methods	20%	✓	✓	✓
5.	**Explain** role of Internet of Things in a smart city	20%	✓	✓	
		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	
Lectures	Learning through teaching is primarily based on lectures. Mini-lectures and small-group exercises will be used to facilitate conceptual understanding of smart cities and applications of various data science tools and techniques to improve smart cities.	✓	✓	✓	✓	✓	26 hours/sem
Tutorial Exercises	The team-based exercises provide students with the opportunities to familiarize and apply the data science tools learnt during the lectures through practical problem solving.			✓	✓	✓	13 hours/sem

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		
Continuous Assessment: 70 %							
Test			✓	✓	✓	20%	
Assignments			✓	✓	✓	20%	
Group Project	✓	✓	✓	✓		30%	
Examination: 30 % (duration: 2 hours , if applicable)							
Examination	✓	✓	✓	✓	✓	30%	
						100%	

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

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. Test	2-hour test to assess students' conceptual understanding of data science methods for smart city applications.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignments	Students' ability to understand the role of data science in smart cities and to utilize real data set for smart city design or operation. Explanation and presentation of results are also assessed.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Group Project	Students' ability to adopt a systematic and data science methodology based approach to a smart city application are assessed through written report and oral presentation. Such approach should be observable throughout the stream of problem identification and justification, data collection, data analysis, inferences, and discussion of implication of results.	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examination	Examination questions are designed to assess student's level of achievement of the intended learning outcomes, with emphasis placed on conceptual understanding and correct application of data science methods for smart city applications.	High	Significant	Moderate	Basic	Not even reaching marginal levels

The midterm, tutorial exercises and laboratory report will be numerically-marked, while examination will be numerically-marked and grades-awarded accordingly.

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

1. Keyword Syllabus

(An indication of the key topics of the course).

- Recent worldwide smart city development initiatives and future trends
- Review of systems and processes concepts
- Review of data analytics and machine learning techniques commonly used in smart city applications
- Core smart city concept I: intelligent and green energy development
- Core smart city concept II: smart buildings and energy conservations
- Core smart city concept III: intelligent transportation and its infrastructure

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.)

Course powerpoint slides offered

2.2 Additional Readings

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

1.	McQueen, B. (2017). *Big Data Analytics for Connected Vehicles and Smart Cities*. Artech House.
2.	Dey, N., Hassanien, A. E., Bhatt, C., Ashour, A. S., & Satapathy, S. C. (Eds.). (2018). *Internet of Things and big data analytics toward next-generation intelligence*. Springer International Publishing.
3.	Dey, N. and Tamane, S. (2018). Big Data Analytics for Smart and Connected Cities. IGI Global. DOI: 10.4018/978-1-5225-6207-8