SDSC6004: DATA ANALYTICS FOR SMART CITIES

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Data Analytics for Smart Cities

Subject Code
SDSC - Data Science
Course Number
6004

Academic Unit
Data Science (DS)

College/School
College of Computing (CC)

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

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. Students in this course will learn 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. Student will be exposed to four knowledge modules: mobility and transportation, building energy systems, extreme events and urban resilience, and climate change and environmental variability. Throughout the course, students will gain the ability of leveraging real data to solve smart city application problems via basic statistics and machine learning techniques.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain data science principles in the design and operation of smart cities	20	x		
2	Learn smart city applications that are revolutionized by the increasing availability of data	20	x		
3	Apply the appropriate data science methods to various smart city applications	20	x		
4	Improve the design or operation of a smart city by using data analytic methods	20	x	x	
5	Explain role of Internet of Things in a smart city	20	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	Learning through teaching is primarily based on lectures. Students will participate in mini-lectures and small-group exercises to facilitate conceptual understanding of smart cities and applications of various data science tools and techniques to improve smart cities.	1, 2, 3, 4, 5	30 hours/sem

2	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.	3, 4, 5	9 hours/sem

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Attendance	1, 2	5	
2	Group Project	1, 2, 3, 4	45	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

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

Assessment Rubrics (AR)

Assessment Task

Attendance (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

The attendance and interactive performance of students in each lecture and tutorials will be recorded to reflect the in-course performance

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Group Project (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Students will practice in adopting a systematic and data science methodology based approach to realize a smart city application. Written report and oral presentation will be conducted. Such approach should be observable throughout the stream of problem identification and justification, data collection, data analysis, inferences, and discussion of implication of results.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Students will examine their level of achievement of the intended learning outcomes via designed exams, with emphasis placed on conceptual understanding and correct application of data science methods for smart city applications.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal

(D) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Attendance (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

The attendance and interactive performance of students in each lecture and tutorials will be recorded to reflect the in-course performance

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

Marginal

(B-, C+, C) Basic

Failure

(F) Not even reaching marginal levels

Assessment Task

Group Project (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Students will practice in adopting a systematic and data science methodology based approach to realize a smart city application. Written report and oral presentation will be conducted. Such approach should be observable throughout the stream of problem identification and justification, data collection, data analysis, inferences, and discussion of implication of results.

Excellent

(A+, A, A-) High

Good

(B+, B) Significant

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Failure

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Assessment Task

Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion

Students will examine their level of achievement of the intended learning outcomes via designed exams, with emphasis placed on conceptual understanding and correct application of data science methods for smart city applications.

Excellent

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Part III Other Information

Keyword Syllabus

- 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

Reading List

Compulsory Readings

	Title
1	Course powerpoint slides offered

Additional Readings

	Title
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