

JEE 688 Data Science for Environmental and Energy Studies

Version: 30 July 2024 (with minor correction on 30 June 2026)

1. Course Description

This graduate-level course introduces essential elements of data science and its ecosystem, as motivated by their significance and utility in today-world applications, including environmental and energy issues. The course is designed to prepare students to be equipped not only with basic knowledge but initial familiarity to certain data tools and open data to necessarily enhance their academic research and future career. The course begins with an overview of data science and the world of data, followed by data attributes and conventions. The backbone of the course is dedicated to data analytics, which covers data handling & wrangling, statistics, and predictive methods. Real-world data-related applications are illustrated for additional perspectives. The course employs a mixed approach with emphasis on lectures, complemented by tool-based demonstration and a mini class project.

2. Target Knowledge, Skills, and Abilities (KSA)

Knowledge: Essential elements of data science and its ecosystem

Skills: Initial familiarity to selected standard open-source tools and open data

Abilities: Data handling and data

3. Target group of students

- a. PhD and MS students at JGSEE
- b. (Optional) PhD and MS students at KMUTT in engineering and science
- c. (Optional) Non-degree interested persons

4. Pre-requisites

None

5. Course Learning Outcomes [Indicate the alignment of CLOs with the PLOs]

Students are expected to be able to

CLO1: Understand the essential elements of data science and its ecosystem

- ECS aligned: PLO2, PLO4
- SES aligned: PLO2, PLO3

CLO2: Develop initial familiarity with selected open-source data tools

- ECS aligned: PLO2
- SES aligned: PLO2

CLO3: Conceptualize the utility of data science and open data in environment and energy

- ECS aligned: PLO3, PLO6
- SES aligned: PLO5, PLO6

6. Method of Teaching and Learning

Online, on-site, or hybrid (all applicable)

7. Course Outline and Organization

Open every semester or one semester annually, depending on if assigned core or elective

Module 1: Essential concepts		
MLO1: Understand the essential elements of data science and its ecosystem ○ ESC aligned: LO2.6, LO4.1 ○ SES aligned: LO2.2, LO3.0		
MLO2: Develop initial familiarity with selected open-source data tools ○ ESC aligned: LO2.2 ○ SES aligned: LO2.2		
MLO3: Conceptualize the utility of data science and open data in environment and energy ○ ECS aligned: LO3.1 ○ SES aligned: LO6.0		
Lecture	Instructor	Teaching Period
Lecture 1: Course introduction & Data world	Kasemsan	1 week
Lecture 2: Data world (continued)	Kasemsan	1 week
Lecture 3: Space-time convention and data format	Kasemsan	1 week
Lecture 4: R, Python, and QGIS in a very nutshell	Kasemsan	1 week
Lecture 5: Exploratory data analysis	Kasemsan	1 week
Lecture 5: Exploratory data analysis (continued)	Kasemsan	1 week
Lecture 7: Basic statistics	Kasemsan	1 week
Lecture 8: Feature engineering	Kasemsan	1 week
Lecture 9: Feature engineering (continued)	Kasemsan	1 week
Lecture 10: Time series	Kasemsan	1 week
Lecture 11: Database and query	Kasemsan	1 week
Lecture 12: Statistical modeling + AI & ML	Kasemsan	1 week
Lecture 13: Statistical modeling + AI & ML (continued)	Kasemsan	1 week
Module 2: Real-world perspectives		
MLO1: Conceptualize the utility of data science and open data related to environment and energy ○ ECS aligned: LO6.1 ○ SES aligned: LO5.0		
Lecture	Instructor	Teaching Period
Lecture 14: Topic of interest (e.g., current trends or mini class-project discussion)	Kasemsan	1 week
Lecture 15: Self-exercise	None	1 week
Lecture 16: Mini class-project submitted and examination	Kasemsan	1 week
Remark: All lectures are given by Dr. Kasemsan. They may possibly be supported by his teaching assistants (e.g., senior researchers or PhD students) (to be determined or TBD). As for external lecturers invited by JGSEE (i.e., guest), none are currently planned.		

8. Evaluation Methods

- a. Take-home examination, given in the end of semester (50%)
- b. Mini class project submitted in the end of semester 2 (40%)
- c. Class participation throughout the semester (10%)

9. Guided References/Resources

- a. Lecture notes of the main instructor.
- b. Many free online books in the internet