SDSC6025: AI FOR MATERIALS SCIENCE

New Syllabus Proposal

Effective Term
Semester A 2026/27

Part I Course Overview

Course Title
AI for Materials Science

Subject Code
SDSC - Data Science
Course Number
6025

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
Fundamental knowledge of materials science; Calculus; Linear algebra; Basic knowledge in Python.

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This teaching plan offers a structured exploration of artificial intelligence (AI) applications in materials science, with adaptable content depth tailored to various expertise levels. It encompasses introductory lectures on AI relevance in materials science, progressing to data science fundamentals and hands-on activities. The curriculum includes AI tools, supervised and unsupervised learning techniques, and data-driven optimization strategies applicable to materials science. Key topics such as Convolutional Neural Networks, boosting algorithms, dimensionality reduction techniques, and Bayesian optimization are covered in depth()3-month timetable details weekly sessions, including lectures, practical exercises, and assignments to reinforce learning. Students will engage in hands-on projects to apply AI techniques to real-world materials science problems, culminating in a comprehensive exam and final project. The plan emphasizes collaborative learning and flexibility to accommodate varying student backgrounds.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Mastering the concept of artificial intelligence and its application in materials science	25	x		
2	Ability to program in python and relevant AI code	25	x		
3	Apply data-driven tools to materials science problems	25		x	
4	Discuss state-of-the-art development in the relevant areas and to form opinions on specific issues.	25			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		1, 2, 3, 4	25 hours/sem
2	Tutorials		1, 2, 3, 4	6 hours/sem
3	Assignments		1, 2, 3	8 hours/sem

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments	2, 3, 4	60	-	Yes

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)
2

Minimum Examination Passing Requirement (%)
30

Assessment Rubrics (AR)

Assessment Task
Assignments (for students admitted in Semester A 2026/27 & thereafter)

Criterion
Train students' ability to theorize and solve various types of AI for materials science problems.

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 in Semester A 2026/27 & thereafter)

Criterion
It assesses students' ability to theorize and solve various types of AI for materials problems.

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

Part III Other Information

Reading List

Additional Readings

	Title
1	Ian Goodfellow and Yoshua Bengio and Aaron Courville. Deep Learning. 2016. ISBN: 978-0262035613.
2	Charles Audet and Warren Hare. Derivative-Free and Blackbox Optimization. 2017. ISBN: 978-3319689128
3	Laura Igual , Santi Seguí. Introduction to Data Science. 2024. ISBN: 978-3031489556