NJIT New Jersey's Science & Technology University

NEWARK COLLEGE OF ENGINEERING

SDET 101: Fundamentals of Software and Data Technologies- I

The world is rapidly shifting towards a software and data-centric paradigm. The merging of these two domains is laying the groundwork for the next technological revolution, where Artificial Intelligence (AI) is demonstrating boundless potential.

This course will delve into the intricacies of modern software and data technologies, emphasizing their intertwined nature as it applies to Engineering Technology. Students will embark on a gentle journey through Python programming, understanding its pivotal role in data collection, analysis, and the underpinnings of AI. We will explore the ethics of tech and AI, learn about the basics of machine learning, and gain insights into real-world applications of AI across various fields.

This course is restricted to Engineering Technology majors. Other majors require department approval to register. No prerequisites are required to enroll. The lectures and hands-on labs are designed to complement each other, providing students with both theoretical knowledge and practical skills. This course is worth 3 credits and is positioned to be a steppingstone for students into the world of software, data, and AI.

Instructor:

Craig Iaboni
Email: csi3@njit.edu

Office Hours:

- 3 total hours for online meetings via WebEx. Students should email at least 12 hours in advance for setting up an online session.

Office Hours Policy:

Please come prepared with your fully documented attempted work. This will help maintain fairness in the class for other students as well as ensure an efficient use of everyone's time. Students who do not show prior attempt of their work during the office hours may be asked to attempt the problem before receiving consulting time.

Study Material:

All study material will be released via Canvas. No particular textbook is required for this class. Instead, notes and slides will be provided for study. Publicly available and/or proprietary articles, videos, tutorials, and datasets will be used in this class.

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Course Structure:

Students will work individually or in pairs for the class. Student groups (individual or pairs) should be formed by the end of Week 2 of the term. Each working week, I will upload learning material in the content folders – videos, open source articles, technical manuals, etc. Accompanying this material will be reading, writing, and coding assignments, and technical questions about software and/or hardware related to embedded systems. Each assignment will have a deadline mentioned in the Canvas system.

Learning Objectives:

By the end of the course, students will be able to:

1. Identify the interplay between software and data in the modern technological landscape when applied to different industries.
2. Demonstrate proficiency in Python by developing programs for data collection, processing, and analysis for Engineering Technology applications.
3. Analyze basic algorithms and structures used in artificial intelligence, machine learning, and neural networks.
4. Apply ethical considerations when handling and processing data, especially in AI-driven projects for the Engineering Technology domain.
5. Utilize Python libraries to visualize, clean, and interpret real-world datasets effectively.
6. Implement basic machine learning models, ensuring proper data preprocessing and model evaluation.
7. Construct simple AI applications for Engineering Technologists.
8. Evaluate real-world case Engineering Technology studies to discern the implications and applications of AI in various fields.
9. Collaborate effectively on software and data projects for Engineering Technology, emphasizing efficient teamwork and communication.
10. Document progress, challenges, and solutions in a structured manner, showcasing their journey throughout the course.

Student Outcomes:

The Course Learning Outcomes support achievement of the following Student Outcomes from the ETAC of ABET Criterion 3 requirements.

Specifically, this course can address the following ETAC outcomes:
ETAC Student Outcomes: 1, 2, 3, 4, 5, 6, 8, 9

Table 1: Topical Breakdown (tentative - subject to change)

Week #	Topic	Activities	Learning Outcome
1	The Modern Engineering Technology Landscape	- Introduction to AI-centric world - Introduction to Python	Understand the significance of AI as it applies to Engineering Technology and get acquainted with Python
2	Laying the Foundations: Python Basics	- Python syntax - Basics of Lists and Dictionaries	Gain basic Python programming skills and understand fundamental data structures
3	Flow Control and Logic	- Control structures exercises - Mini projects	Develop algorithmic thinking and understand decision-making in code
4	Introduction to Data and Its Importance	- Overview of data's role - Simple database exercises	Demonstrate the role of data in modern Engineering Technology and basics of data collection/storage
5	Basics of Data Analysis with Python	- Visualization with Python libraries - Real-world dataset analysis	Demonstrate skills in basic data analysis and visualization for Engineering Technology Domains
6	Intro to Software Design and Object-Oriented Programming	- Software design principles - OOP: Classes and Objects	Demonstrate a high-level understanding of software design principles and the basics of OOP
7	Intro to Machine Learning	- Introduction to ML - Simple linear regression with Python	Understand the basics of Machine Learning and its significance as applied to Engineering Technology domains

8	Basics of Web and Data: Interaction with the Internet	- Basics of the internet - Web scraping and APIs	Learn how to fetch real-world data from the web and understand the internet's foundations
9	Basic Data Cleaning and Preprocessing	- Data cleaning techniques - Data preprocessing exercises	Demonstrate simple Python coding techniques for data preparation
10	Ethics in Engineering Technology and AI	- Introduction to Engineering Technology ethics - Case studies & discussions	Grasp the ethical considerations and potential biases in AI and Engineering Technology
11	A Glimpse into Neural Networks	- Introduction to neural networks - Using a pre-built neural network	Gain a high-level understanding of neural networks and their structure
12	Real-world Applications of AI in Engineering Technology	- Introduction to NLP & computer vision - AI impact case studies	Understand the practical applications of AI in various Engineering Technology domains and its societal impacts
13 - 15	Collaborative Development and Teamwork and Capstone Project	- Teamwork in software projects - Introduction to version control - Project presentations - Course review & feedback	Learn the basics of collaborative software development and teamwork. Apply the knowledge gained throughout the course in a practical Engineering Technology project. Showcase understanding and skills developed throughout the course and reflect on learning experiences

Table 2: Numerical grade breakdown

Item*	Breakdown**
Assignments	30
Midterm Exam	30
Final Exam	30
Attendance	10
Total	**100/100**

Policies

1. No late submissions/presentations will be accepted, except for valid medical reasons or prior arrangement with Mr. Iaboni.
2. Plagiarism will result in zero (0) points. Additionally, all academic policies set forth by NJIT University will be followed. NJIT has a zero-tolerance policy regarding cheating of any kind and student behavior that is disruptive to a learning environment. Any incidents will be immediately reported to the Dean of Students. Please visit the Dean of Students website at http://www.njit.edu/doss for a list of student policies relating to academic integrity and student conduct.
3. All NJIT policies regarding adding, dropping, and withdrawing from courses will be followed. In order to insure consistency and fairness in application of the NJIT policy on withdrawals, student requests for withdrawals after the deadline (end of the 9th week of classes) will not be permitted unless extenuating circumstances are documented. The course instructor and the Dean of Students are the principal points of contact for students considering withdrawing from a course.
4. When a student invokes extenuating circumstances for any reason (late withdrawal from a course, request for a make-up exam, request for an Incomplete grade) the student will be referred to the Dean of Students Office. The Dean of Students will be making the determination of whether extenuating circumstances exist or not and will be notifying the instructor accordingly. Instructors will never request or accept medical or other documents from students; such documents need to be submitted by the student to the Dean of Students.
5. Student with disabilities requesting accommodations and services at NJIT need to present a current Letter of Accommodation Eligibility from the Disability Support Services office authorizing student accommodations to faculty before accommodations can be made.

- For additional information, contact The Disability Support Services office (http://www.njit.edu/studentsuccess/disability-support-services-0/)

6. Final letter grades will depend on the final numerical grades and will follow letter grade cutoffs provided below. The final numerical grades will be ascertained based on the statistical analysis performed at the end of the term.

Letter	Numeric Grade
A	90 and Above
B+	85 to 89.9
B	80 to 84.9
C+	75 to 79.9
C	70 to 74.9
D	60 to 69.9
F	Below 60

7. E-mail Etiquette and Policy:
In general, it is preferred that class related questions be asked during class, so that everyone can benefit from the discussion. If your answer requires a longer time to answer, please ask in person outside or after class. You may ask questions over email if the instructor is unavailable.

It is recommended that students email the professor well in advance of an upcoming deadline. Emails received 24-36 hours prior to a deadline may not be answered prior to the deadline.

Business etiquette for electronic communications must be adhered to when asking course related questions. This includes a formal greeting (for example: Dear Professor Abichandani), a subject line, formal language, and a formal signature line (including your full name and Student ID). Emails that do not follow proper etiquette might not be answered. Please make sure your NJIT e-mail account is active and checked daily for class communication and updates.

Sample e-mail:

Subject: SDET 101: Homework 2 Related Question

Body:

Dear Professor Abichandani,

This is John Doe from your ECET 411 class, I have a question concerning Homework 2. I am confused about how to use the command line interface in Linux? Specifically, I am unable to move a file from one folder to the other – here is a screen video of my attempt.

Can you please help me with this?

Thank you,

John Doe

NJIT SID: 123123123

Email: john.doe@njit.edu

Accommodation for Disability

If you have a documented physical and/or learning disability, please feel free to inform me or the NJIT Counseling Center (http://www.njit.edu/counseling/services/disabilities.php) regarding what kind of accommodation you need to help you succeed in this class. While you are not required to disclose your disability to me, you must provide appropriate documentation to receive official university assistance. All such requests will be held confidential to the fullest extent possible.

Modification to Course:

The Course Outline may be modified at the discretion of the instructor or in the event of extenuating circumstances. Students will be notified in class of any changes to the Course Outline.

SDET 101/102 Assignment Rubric

This rubric is designed to be used for assignments involving programming, data manipulation, API interaction, and database usage in SDET 101 and 102.

Category	Criteria	Points
Functional Correctness	- Code meets the requirements of the problem (all tasks attempted) - Produces the correct and expected output - Logic is sound and accurate	35
Code Quality and Structure	- Code is clean, modular, and uses functions/classes where appropriate - Follows Python best practices (PEP-8 style, meaningful variable names)	20
Comments and Documentation	- Code includes helpful inline comments - Functions include docstrings (if used) - Code is understandable by another reader	10
Error Handling	- Anticipates and handles common runtime errors (e.g., file I/O, API failures, user input) - Try/except blocks are used thoughtfully	10
Use of Tools and Technologies	- Appropriate use of standard libraries (e.g., requests, sqlite3) - Demonstrates correct usage of API calls, database interactions, etc.	10
Creativity and Efficiency	- Student demonstrates cleverness or efficiency in their approach - Goes beyond minimum requirements in interesting, relevant ways	10

Submission Quality	- All required files are submitted and run without modification - Code is separated logically (multiple files or clearly structured script) - Instructions for running are clear (if needed)	5