FRE 521D

Data Analytics in Climate, Food and Environment

Asif Ahmed Neloy

UBC Master of Food and Resource Economics | Winter 2026

Course Overview

Build end-to-end data pipelines for climate, food, and environmental sectors. Transform raw data into stakeholder-ready insights through practical, hands-on projects.

WEEKS 1-2

SQL and Schemas

Database design, joins, CTEs, window functions, data contracts

WEEKS 2-3

ETL Pipelines

Files, APIs, authentication, pagination, data layers

WEEKS 3-5

Python Wrangling

Tidy data, merges, cleaning, validation rules

WEEK 6

Visualization

Matplotlib, Plotly, storytelling with data

Learning Objectives

By the end of this course, you will be able to:

- Design and implement relational database schemas with proper normalization and data contracts
- Build ETL pipelines that extract data from files and APIs with proper error handling
- Apply Python data wrangling techniques including merges, reshaping, and tidy data principles
- Implement data validation rules, handle missing values, and detect outliers systematically
- Create effective visualizations that communicate insights to technical and non-technical audiences

Course Flow

Each assignment builds toward the final integrated project

ASSIGNMENT 1

SQL Access Layer

Due: Jan 14

Schema, joins, CTEs, contracts

+

ASSIGNMENT 2

ETL and Validation

Due: Feb 2

APIs, files, cleaning, validation

+

FINAL PROJECT

Integration and Presentation

Due: Feb 11

Combine datasets, visualize, business story

Two datasets per team: You will work with different datasets in A-1 and A-2, then integrate them in the final project to create a unified analytical pipeline with business storytelling.

Required Software

Install before the next class. A detailed installation guide will be provided.

Anaconda

Python distribution with Jupyter, pandas, numpy

anaconda.com/download

Visual Studio Code

Code editor with Python and SQL extensions

code.visualstudio.com

PostgreSQL

Relational database for local development

Mac: postgresapp.com | Win: postgresql.org/download/windows

DBeaver

Database management and SQL interface

dbeaver.io/download

Git

Version control for code and collaboration

Mac: git-scm.com/download/mac | Win: git-scm.com/download/win

Google Cloud SDK

Command-line tools for BigQuery

cloud.google.com/sdk/docs/install

Postman

API testing and exploration tool

postman.com/downloads

All software is free. Step-by-step installation guide will be shared via email.

Recommended Resources

No required textbook. These resources support your learning.

BOOKS

Python for Data Analysis

Wes McKinney, 3rd Edition

Pandas, data wrangling

Learning SQL

Alan Beaulieu, 3rd Edition

SQL fundamentals, joins

Data Visualization

Claus O. Wilke (Free Online)

Chart selection, best practices

ONLINE DOCUMENTATION

PostgreSQL Docs

postgresql.org/docs

BigQuery Docs

cloud.google.com/bigquery/docs

Pandas User Guide

pandas.pydata.org/docs

Assessment Breakdown

Component	Weight
Assignments (2)	20%
Quizzes (3)	30%
Group Project and Report	30%
Labs	15%
Participation and Case Study	3% + 2%
Total	**100%**

Assignments

Individual work. Two assignments building your data pipeline skills.

Group Project

Teams of 3-4. Integrate datasets and present business insights.

Labs

In-class exercises. Must be submitted during class time.

Participation

Attendance, engagement, and contributions to class discussions.

Quiz Information

QUIZ 1

January 19

SQL and Schemas

QUIZ 2

February 2

ETL and Wrangling

QUIZ 3

February 9

Cleaning and Visualization

FORMAT

In-class, closed book

No notes, no electronic devices. Paper-based examination during regular class time.

CONTENT

Cumulative topics

Each quiz covers material from lectures up to that point. Focus on concepts and practical application.

DETAILS

Coming next week

Specific format, duration, and sample questions will be provided in the next class.

Assignment Overview

Individual work. Each assignment builds skills for the final project.

ASSIGNMENT 1

Due: Jan 14

SQL Access Layer

Design database schemas and write SQL queries for your assigned dataset.

Deliverables:

ERD and schema documentation, joins and CTEs, window functions, pivot/unpivot operations, aggregations, table contracts, analysis-ready view

ASSIGNMENT 2

Due: Feb 2

ETL and Validation

Build ETL pipelines and implement data validation for a second dataset.

Deliverables:

File and API extraction scripts, raw and cleaned data layers, validation rules, error handling, data quality documentation

Final Project

Integrate your work from both assignments into a unified analytical pipeline.

Integration and Business Presentation

Combine the two datasets from your assignments. Create visualizations that communicate actionable insights. Present a data-driven story to stakeholders.

Deliverables

Integrated codebase, visualizations, written report, in-class presentation

Presentation

10-12 minutes per group, followed by questions from class

Presentations: February 11, during regular class time

TEAM FORMATION

Groups of 3-4

Form your own team or be assigned to one.

DEADLINE

January 10

Submit team via Canvas. If no submission, you will be assigned to a group.

Course Policies

LATE SUBMISSIONS

No late submissions accepted. Late work receives a mark of zero unless prior arrangements are made with the instructor.

LAB SUBMISSIONS

Labs must be submitted during class time. No extensions will be granted for lab exercises.

ACADEMIC INTEGRITY

This course follows UBC and MFRE academic integrity policies. Plagiarism, cheating, and other forms of academic misconduct will be reported to the Faculty.

AI USAGE POLICY

You must disclose if you have used AI tools in any part of the course, including labs, assignments, and project submissions.

AI DISCLOSURE REQUIREMENTS

State which AI tools were used, describe how they were used, and identify which portions of your work involved AI assistance. Undisclosed AI use is considered academic misconduct.

ATTENDANCE

Regular attendance is expected. Participation marks are based on attendance and engagement in class discussions.

NEXT STEPS

Before Next Class

1

Install Software

Follow the installation guide sent via email

2

Form Teams

Submit team by January 10 via Canvas

3

Review SQL Basics

Refresh SELECT, WHERE, JOIN concepts

Office Hours: Monday and Wednesday, 11:30 AM - 12:30 PM

Questions? Reach out via email or visit during office hours.