SEMESTER COURSE OFFERED:	Fall 2022
DEPARTMENT:	Petroleum Engineering
COURSE NUMBER:	PETR 5397
NAME OF COURSE:	Petroleum Data Analytics
NAME OF INSTRUCTOR:	Mohamed Ibrahim Mohamed, PhD
Class Time:	Tuesday 5:30PM - 8:30PM
Office Hours for Instructor	Monday 6:00 pm – 7:00 pm via Zoom
Name of TA:	TBD
Office Hours for TA:	TBD

Course Description

This is an elective undergraduate course on data analytics techniques and practices in the oil and gas industry and suitable for petroleum engineers/geoscientists. The course is highly interactive and focuses on building a strong data analytics foundation as well as introduction on python coding. The students will be able to implement data-driven methods on surface and subsurface data including but not limited to earth science, drilling, completions, and reservoir engineering. Students will implement data-driven and data analytics workflow on real-world case studies and petroleum engineering problems. The hands-on nature of the course will allow the students to integrate data science and machine learning methods into the application of petroleum engineering data science problems. The first two weeks of the course will focus on fundamental training for python coding.

Learning Objectives

- Master the depth of knowledge required to assemble data mining workflows in Python to solve complex data science problems and fundamental training for python coding is provided.
- Evaluate and analyze variety of petroleum engineering problems created by big data environments, frame projects taking into considerations, business prospective, scalability of the solutions and artificial intelligence topics and justify the value in solving these problems.
- Master the knowledge of data wrangling and cleaning, data analysis, exploration, and visualization, and methodology selection including supervised learning (classification and regression), unsupervised learning (transformations, clustering, and feature extraction), time series analysis, text analytics, and advanced data science techniques (neural networks, optimization, etc.)

- Apply statistics, data-driven principles, and data analytics (e.g., linear regression, process models, time series analytics, anomalies detection etc.) to address challenges in various petroleum disciplines.
- Demonstrate professionalism, work collaboratively and participate effectively in teams' projects while exhibiting integrity, accepting responsibility, and taking initiative.

Course ABET Student Outcomes

This course addresses the following undergraduate petroleum engineering ABET student outcomes, (1) through (7), which prepare graduates to attain the program educational objectives. ABET outcomes satisfied by the course are highlighted in yellow.

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Major Assignments/Exams

The course grades will be assigned as follows:
Class Participation 10%
Homework Assignments 40%
Midterm Exam 25%
Final Exam 25%

There will be about 3-4 assignments.

The midterm will be given during the class period on April 4th, 2022. The final examination will be given according to UH's examination schedule.

Note: No late projects will be accepted unless the delay is granted by the instructor in advance and for a valid reason.

References

Class notes

Assigned Technical papers and books

List of discussion/Lecture topics

1. Introduction, getting started with python and important libraries (2 Lectures)
2. Overview of data analytics and machine learning applications in petroleum engineering and digital oil field.
3. Data cleaning, and wrangling
4. Exploratory data analysis and data visualization techniques
5. Review of statistics and analytics techniques
6. Regression and trees
7. Supervised learning
8. Unsupervised learning
9. Time series analysis
10. Text analytics
11. Business problem framing

Grading System:

A	95-100
A-	90-94
B+	86-89
B	83-85
B-	80-82
C+	76-79
C	73-75
C-	69–72
D+	66-68
D	63-65
D-	59-62
F	58 or below

General Course Policies

In general, homework will be posted on Wednesday. The homework is due the following Wednesday by 12:00 pm (noon), unless specified. Late Homework will not be accepted. Expect about 5-6 homework assignments during the semester. Assigned Homework will be submitted only via BLACKBOARD.

You are expected to be in class by the start of the class.

Cheating Incidence will be reported.

Grades for quizzes will be part of the homework assignments. There will be a quiz in the first lecture, but no grade attached to it. Quizzes will be announced in advance in the prior lecture. Your instructor will not be able to identify your personal responses during the course and researchers will not attempt to identify individuals. Your data may be aggregated for analysis and publication purposes.

Attendance and participation in guest lectures are mandatory.

UH Covid Policy:
https://www.uh.edu/covid-19/

Religious Holidays:

Students whose religious beliefs prohibit class attendance on designated dates or attendance at scheduled exams may request an excused absence. To do this, you are strongly encouraged to request the excused absence in writing before the last day to drop without record for the semester. Please submit this written request to your instructor immediately, to allow the instructor to make appropriate arrangements. For more information, see the Student Handbook. In any event, request must be received by the instructor 14 calendar days in advance of the day for which the absence is being requested.

Students with Disabilities:

The University of Houston System complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, pertaining to the provision of reasonable academic adjustments/auxiliary aids for students who have a disability. In accordance with Section 504 and ADA guidelines, the University of Houston strives to provide reasonable academic adjustments/auxiliary aids to students who request and require them. If you believe that you have a disability requiring an academic adjustments/auxiliary aid, please contact Center for Students with Disabilities at http://www.uh.edu/csd/

Students with recognized disabilities will be provided reasonable accommodations, appropriate to the course, upon documentation of the disability with a Student Accommodation Form from the Center for Students with Disabilities. To receive these accommodations, you must request the specific accommodations, by submitting them to the instructor in writing by the last day to drop without record. If a student is first granted accommodations by the Center for Students with Disabilities after this deadline, the student shall provide notice to the instructor at least 14 days in advance of the date for which the accommodation is being requested. Providing the accommodation notification of the day of a test, for example, does not provide reasonable time for the instructor to accommodate the request. For more information, see the Student Handbook.

CAPS

Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless. You can reach CAPS (www.uh.edu/caps) by calling 713-743-5454 during and after business hours for routine appointments or if you or someone you know is in crisis. No appointment is necessary for the "Let's Talk" program, a drop-in consultation service at convenient locations and hours around campus. http://www.uh.edu/caps/outreach/lets_talk.html

Dropping the Course:
You may drop the course through enrollment services on-line without receiving a grade until the date specified in the academic calendar for each semester. After this date and until the University's last day to drop for the semester as specified in the academic calendar, you may drop with a W if you have not exceeded your total W limit. Do not assume that the instructor will drop you if you stop attending class. You are responsible for completing the withdrawal procedure.

Correction of Grading Errors:
Sometimes a "grader" may make mistakes. Mistakes include not "seeing" all of a student's solution, not recognizing an alternative solution, or simply not adding up the points earned on all questions correctly. The instructor will do everything in their power to rectify mistakes in grading. Note that correcting grading errors does not include negotiating for points nor negotiating the amount of partial credit a part of a question is due. Correction is for grading errors only. Student usually have one week from the time the grade is assigned to contest it.

Required Daily Health Self-Assessment

Your presence in class each session means that you have completed a daily self-assessment of your health/exposure.

If you are experiencing any COVID-19 symptoms that are not clearly related to a pre-existing medical condition, please be considerate of others. Please see COVID-19 Diagnosis/ Symptoms Protocols for what to do if you experience symptoms and Potential Exposure to Coronavirus for what to do if you have potentially been exposed to COVID-19. Consult the (select: Undergraduate Excused Absence Policy or Graduate Excused Absence Policy) for information regarding excused absences due to medical reasons.

Excused Absence Policy
Regular class attendance, participation, and engagement in coursework are important contributors to student success. Absences may be excused as provided in the University of Houston Undergraduate Excused Absence Policy and Graduate Excused Absence Policy for reasons including: medical illness of student or close relative, death of a close family member, legal or government proceeding that a student is obligated to attend, recognized professional and educational activities where the student is presenting, and University-sponsored activity or athletic competition. Under these policies, students with excused absences will be provided with an opportunity to make up any quiz, exam or other work that contributes to the course grade or a satisfactory alternative. Please read the full policy for details regarding reasons for excused absences, the approval process, and extended absences. Additional policies address absences related to military service, religious holy days, pregnancy and related conditions, and disability.

Recording of Class

Students may not record all or part of class, livestream all or part of class, or make/distribute screen captures, without advanced written consent of the instructor. If you have or think you may have a disability such that you need to record class-related activities, please contact the Center for Students with DisABILITIES. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Classes may be recorded by the instructor. Students may use instructor's recordings for their own studying and notetaking. Instructor's recordings are not authorized to be shared with *anyone* without the prior written approval of the instructor. Failure to comply with requirements regarding recordings will result in a disciplinary referral to the Dean of Students Office and may result in disciplinary action.

Syllabus Changes

Due to the changing nature of the COVID-19 pandemic, please note that the instructor may need to make modifications to the course syllabus and may do so at any time. Notice of such changes will be announced as quickly as possible through (*specify how students will be notified of changes*).

Resources for Online Learning

The University of Houston is committed to student success, and provides information to optimize the online learning experience through our Power-On website. Please visit this website for a comprehensive set of resources, tools, and tips including: obtaining access to the internet, AccessUH, and Blackboard; requesting a laptop through the Laptop Loaner Program; using your smartphone as a webcam; and downloading Microsoft Office 365 at no cost. For questions or assistance contact UHOnline@uh.edu.

UH Email

Email communications related to this course will be sent to your Exchange email account which each University of Houston student receives. The Exchange mail server can be accessed via Outlook, which provides a single location for organizing and managing day-to-day information, from email and calendars to contacts and task lists. Exchange email accounts can be accessed by logging into Office 365 with your Cougarnet credentials or through Access UH. Additional assistance can be found at the Get Help page.

Webcams

Access to a webcam is required for students participating remotely in this course. Webcams must be turned on (*state when webcams are required to be on and the academic basis for requiring them to be on*). (*Example: Webcams must be turned on during exams to ensure the academic integrity of exam administration*.)

Policy Acknowledgment

You must sign & submit to your instructor this acknowledgment of the course policies. ***If you fail to do this by the third class session, you will be dropped from the course.***

Name: (printed) _____ **PS ID** _____
<div align="center">Last   First</div>

Confirm that the following statements are true and then sign and date below.

Academic Honesty Statement

✓ I have read the Cullen College of Engineering and University of Houston Academic Honesty Policies contained in the UH Student handbook and https://www.egr.uh.edu/academics/policies/academic-honesty and I agree to abide by its provisions. I understand that the instructors take academic honesty very seriously and, in the cases of violations, penalties may include <u>permanent suspension</u> from the University of Houston.

Course Syllabus

✓ I have read and therefore understand the enclosed Course Syllabus document.

UH E-mail Alias Agreement

Confirm that the following statements are true and then sign and date below.

✓ I have read the University of Houston Information Technology website discussing UH e-mail aliases and I understand how to use this alias to receive e-mail through my outside provider.

✓ I understand that it is my personal responsibility to configure this alias properly to receive mailings from the university.

✓ I understand that the College of Engineering will use this e-mail alias for all official correspondence.

Signature: _____ Date: _____

UH E-mail Alias: _____

Submit this form to Blackboard for this course.