**Syllabus: PETE 2061—Statistics and Data Visualization for Petroleum Engineers**

**COURSE INFORMATION**

**Title:** PETE 2061— Statistics and Data Visualization for Petroleum Engineers (Prereq: MATH 1552.)

**Lectures**: 8:30 – 9:20 am on Mondays in Rm 2243 PFTH

**Lab Sessions**: 9:00 – 10:50 am on Thursdays in Rm 2243 PFTH

**Instructor:** Olufemi M. Olorode

**Office:** PFTH 3209Q

**E-Mail:** [folorode@lsu.edu](mailto:folorode@lsu.edu)

**Office Hours:** Tuesday 10 am – 12 pm and by appointment.

**TA:** Ahmed Abdullah

**Office:** PFTH 2245

**E-mail:** [aabdu27@lsu.edu](mailto:aabdu27@lsu.edu)

**Office Hours:** By appointment.

**Class Communication Protocols**

1. I will continue to communicate with the entire class using Moodle emails and the new “Announcements / Q&A forum” available in the General Information section of the course on Moodle.
2. The preferred way to contact me is by email ([folorode@lsu.edu](mailto:folorode@lsu.edu)). I will always respond within 24 hours.
3. Harun and I will also respond to any questions you post on the “Announcements / Q&A forum” in Moodle. Feel free to use this forum when you have questions on the labs anytime during the week. This will allow other students to learn from your questions and answers.
4. We strongly recommend the use of this forum when you have questions on the labs outside of the class and lab periods. This will allow other students to learn from your questions and answers.

### **Reference Material**

Electronic versions of both of the course texts are available through the LSU libraries for current students using the links below:

* Haslwanter, T., [An Introduction to Statistics with Python, Springer (2016)](http://libezp.lib.lsu.edu/login?url=https://link.springer.com/book/10.1007/978-3-319-28316-6).
* Stephenson, B. [The Python Workbook, Springer (2014)](http://libezp.lib.lsu.edu/login?url=https://link.springer.com/book/10.1007%2F978-3-319-14240-1).

### **Course Description**

Introduction to data collection, visualization, and statistics for petroleum engineers; introduction to modern programming techniques and software used in these applications.

**Goal/Rationale of the Course**

The goal of this course is to build upon previous knowledge of math and scientific problem solving, and develop new skills in computational thinking. Engineering requires problem solving skills. Problem solving quickly becomes too complex or time consuming to perform manually. Since the advent of the computer and especially the personal computer, it has served as a tool for solving problems. Most often these problems are in the form of some type of numerical or mathematical equations. It is pertinent that an engineer learns how to utilize computational power as a tool to solve these numerical problems. As with manual labor, there can be several different types of tools that can get the job done. The best tools are comfortable to those using them and efficiently get the desired results.

This course will introduce you to computational thinking, also known as, computer programming. It will also introduce you to Python, a very effective and ubiquitous programming language that is relevant to the modern petroleum industry. Python and its many libraries of functions will be used to give an introduction to computational problem solving and to data visualization and statistics common to petroleum engineering applications.

**Course Objectives** ​By the end of the course you should be able to do the following things:

* Think computationally. ​Basic programming skills (pseudo-code writing, loops, input and output processing, data types and data handling, syntax, etc.)
* Computation​. Use a programming language (PYTHON) to solve basic statistics problems and do calculations and visualization of data

### **Teaching philosophy**

My approach to teaching this course is a blend of standard lectures with programming demonstrations, possibly some recommended tutorial videos for outside of class. The only way to learn engineering is to practice problem solving. This course will require large amounts of problem solving. The lab environment will be for interactive practice of the methods taught in class. This allows the student to gain practice. Students will need to work and submit all labs at the end of the lab class.

### **Course Policies**

● **Missed Tests**​ - Missed tests will incur a zero score unless the student produces a valid excuse for missing the test. Valid excuses are: Note from medical doctor excusing the student, death of immediate family member. Other personal or family emergencies may be taken under consideration.

● **Electronic Devices**​ - No electronic device usage is allowed during exam. No laptops, no

cellphones, no smartphones, no tablets. Any devices being used will be confiscated and taken to the dean’s office for recovery.

● **Personal Calculators**​ - the petroleum engineering department is instigating a standardized sanctioned calculator for all classes. The ​ONLY​ calculator that will be allowed for use on PETE 2061 exams will be a​ TI 36X-Pro ​calculator. These can be purchased through Amazon, Co-Op Bookstore or many other vendors for less than $20. Make sure though that the one you purchase is a TI 36X-Pro. You will use the same calculator for future courses in petroleum engineering.

**LSU COMMUNICATION ACROSS THE CURRICULUM (CxC)**

This is a certified Communication-Intensive (C-I) course which meets all of the requirements set forth by LSU’s Communication across the Curriculum program, including

* instruction and assignments emphasizing informal and formal technological and visual modes of communication;
* teaching of discipline-specific communication techniques;
* use of feedback loops for learning;
* over 40% of the course grade rooted in communication-based work; and
* practice of ethical and professional work standards.

Students interested in pursuing the[***LSU Communicator Certificate***](https://www.lsu.edu/academicaffairs/cxc/comm_cert/comm_cert_overview.php)and/or the[***LSU Distinguished Communicator Medal***](https://www.lsu.edu/academicaffairs/cxc/distinguished-communicator-program.php)may use this C-I course for credit. And don't forget to check out the[***CxC Studio resources***](https://www.lsu.edu/academicaffairs/cxc/studios.php)for additional support with all your communication projects in this class and beyond! For more information, visit[***www.cxc.lsu.edu***](https://www.lsu.edu/academicaffairs/cxc/index.php).

**GRADING/EVALUATION**

**Grading Scale**

Maximum letter-grade cutoffs are outlined below:

A+ (97.0%)

B+ (87.0%)

C+ (77.0%)

D+ (67.0%)

A (93.0%)

B (83.0%)

C (73.0%)

D (63.0%)

A– (90.0%)

B– (80.0%)

C– (70.0%)

D– (60.0%)

**Grading Policies**

* Lab Assignment (40%) [4% each for best 10 lab submissions]
* Mid-term exam (20%)
* Final exam (20%)
* Project (10%)
* Quizzes (10%) [1% each for best 10 quizzes]

**Communication Assessment Breakdown (29% Tech Mode & 15% Visual Mode)**

* C-I Technological Mode Practice/Process Assessment (**24%**) [Lab assignments 0-5]
* C-I Visual Mode Practice/Process Assessment (**10%**) [Project]
* C-I Technological Mode Demonstration Assessment (**5%**) [Midterm and Final Exam Part 2, question 2]
* C-I Visual Mode Demonstration Assessment (**5%**) [Midterm and Final Exam Part 2, question 1]

**Description of Activities that will be Graded:**

**Lab assignments (40% of course total)**

Lab assignments will be assigned approximately once per week. These lab assignments will emphasize computational skills including data visualization, simple data analysis, and computer programming in Python. The best 10 graded lab assignments will account for 5% each. No excuses will be accepted for not having up to 10 graded lab assignments submitted (out of a total of 12), and there will be no make ups.

**Mid-term Exam (20% of course total)**

A mid-term exam will be taken in class using a seating chart and will focus on everything covered up to that time. The exam grade will be computed as percentage (%) correct. Part 1 of the exam will contain multiple-choice questions, whereas part 2 will involve writing Python codes to solve a simple problem and generate plot(s). Parts 1 and 2 of the exam will each be worth 10% of the total course grade.

**Final Exam (20% of course total)**

A comprehensive final exam will be taken in the assigned classroom at the time and date published in the LSU scheduling book. The exam grade will be computed as percentage (%) correct. Part 1 of the exam will contain multiple-choice questions, whereas part 2 will involve writing Python codes to solve a simple problem and generate plot(s). Parts 1 and 2 of the exam will each be worth 10% of the total course grade.

**Project (10% of course total)**

I will assign a programming project with the opportunity of submitting it two times. The focus will be on writing Python codes to visualize production data and well logs from the Volve field. Feedback will be given after each submission to give directions on how to improve the submitted codes.

**Quizzes and In-Class Work (10% of course total)**

There will be a total of 13 quizzes, and the best 10 will be selected. Each quiz will be worth 1% of the total grade. No excuses will be accepted for not having up to 10 quizzes, and there will be no make-up quizzes.

**Course Schedule (lab programming topics in parentheses)**

|  |  |
| --- | --- |
| **Week Number** | **Tentative Lecture Topic** |
| 1 (08/26-30 | **Lec #1** – Introduction to petroleum engineering data analysis using Python  **Lab #1** – Introduction to variables, data types, and operators in Python  **Lab WB #0** - Python HelloWorld! |
| 2 (09/02-06) | Labor Day Holiday (09/02/2024)page14image39434960page14image33036384  **Lab WB #1** - Implementing Simple Volumetric Reserves Calculations in Python |
| 3 (09/09-13) | **Lec #2** – Numerical approximation and errors  **Lab #2** – Python data types  **Lab WB #2** – Implementing Decline Curve Analysis (DCA)For 4 time steps in a Python List |
| 4 (09/16-20) | **Lab #3** – Numpy arrays and loops in Python  **Lab WB #3** – Implementing DCA using Numpy Arrays |
| 5 (09/23-27) | **Lec #4** – Descriptive statistics  **Lab #4** – Descriptive statistics, Pandas, and control structures in Python  **Lab WB #4** – Implement control structures and dataframes in Python |
| 6 (09/30-10/04) | **Lab #5** – User-defined functions in Python  **Lab WB #5** – Implement user-defined functions in Python |
| 7 (10/07-11) | page14image39434960Pre mid-term review  **Mid-term Exam (10/10/2024)** |
| 8 (10/14-18) | Post mid-term review  **Mid-term Grades due (10/15/2024)**  Fall Holiday (10/17/2024-10/18/2024)page14image39434960 |
| 9 (10/21-25) | **Lec #6** – Introduction to databasespage14image35193024  **Lab #6** – Use of Pandas and JSON for visualization of real production data  **Introduction to Project Workbook (WB)** |
| 10 (10/28-11/01) | **Project WB** – Implement code to retrieve and plot Volve data |
| 11 (11/04-08) | **Lec #7** – Probability page14image35193024(conditional probability, joint probability, Bayes rule)  **Lab #7** – Introduce Itertools for probability, permutations, & combinations  **Lab WB #7** – Perform simple probability calculations in Python |
| 12 (11/11-15) | **Lec #8** – Probability page14image35193024Distributions  **Lab #8** – How to implement probability distributions in Python  **Lab WB #8** – Probabilistic reserves estimation |
| 13 (11/18-22) | **Lec #9** – Inferential Statistics  **Lab #9** – Introduce Itertools for probability, permutations, & combinations  **Lab WB #9** – Perform simple probability calculations in Python |
| 14 (11/25-29) | **Lec #10** – Linear regression  **Lab #10** – How to implement correlation & linear regression in Python  **Lab WB #10** – Use linear regression to find DCA model parameters  Thanksgiving Holiday (11/27/2024 12:30 pm -11/29/2024) |
| 15 (12/02-06) | **Lec #11** – Multivariate Linear regression  **Lab #11** – How to implement multivariate linear regression in Python  **Lab WB #11** – Use backward elimination method to select optimum model  Concentrated study period begins on 12/04/2024  Course revision  **Special Topics (Not Tested in Finals):**   * Introduction to Object-oriented programming * Developing standalone computer programs |
| 16 (12/09-13) | **FINAL EXAM (12/09/2024; from 10:00 am – 12:00 pm)** |
| 17 (12/16-20) | Grades due (12/18/2024 for non-degree candidates) |

**LSU ACADEMIC MISCONDUCT POLICY**

The LSU Code of Student Conduct applies within the Code is the Academic Misconduct Policy, which outlines the expectations for the integrity of students’ academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the LSU Code of Student Conduct Policy and for living up to their pledge ​not​ to violate the Code.

* It shall be a violation of this Code for a student to cheat.
* It shall be a violation of this Code for a student to knowingly circumvent any course requirement.
* It shall be a violation of this Code for a student to steal.
* It shall be a violation of this Code for a student to purposely impair another student's educational opportunity.
* It shall be a violation to act in a manner which is detrimental to the moral and ethical standards of the engineering profession.
* It shall be a violation for a student to knowingly deceive another student, faculty member, or professional associate with the intent to gain advantage, academic or otherwise, for said student or for any other student.
* It shall be a violation for any student to fail to report any infraction of the LSU Code of
* Student Conduct Policy to an appropriate representative.

LSU Code of Student Conduct can be found at: ​[http://saa.lsu.edu/code-student-conduct](http://saa.lsu.edu/code-student-conduct" \o "link to LSU student code)

**General Statements on Academic Integrity**

Louisiana State University adopted the Commitment to Community in 1995 to set forth guidelines for student behavior both inside and outside of the classroom. The Commitment to Community charges students to maintain high standards of academic and personal integrity. All students are expected to read and be familiar with the ​LSU Code of Student Conduct​ and ​Commitment to Community​, found online at [www.lsu.edu/saa](http://www.lsu.edu/saa)​. It is your responsibility as a student at LSU to know and understand the academic standards for our community.

Any problems associated with academic integrity will be referred to the Office of Student Advocacy & Accountability (SAA) and the Dean of Students.

**Plagiarism and Citation Method**

As a student at LSU, it is your responsibility to refrain from plagiarizing the academic property of another and to utilize appropriate citation method for all coursework. In this class, it is recommended that you use Vancouver System of citation​. ​ Ignorance of the citation method is not an excuse for academic misconduct. Remember there is a difference between paraphrasing and quoting and how to properly cite each respectively.

One tool available to assist you in correct citations is the “References” function in Microsoft Word. This program automatically formats the information you input according to the citation method you select for the document. This program also has the ability to generate a reference or works cited page for your document. The version of Microsoft Word with the “References” function is available in most University computer labs. A demonstration of how to use this tool is available online at​ ​[www.lsu.edu/saa](http://www.lsu.edu/saa).

**Behavioral Misconduct**

Per section 5.1 of the [Code of Student Conduct](https://www.lsu.edu/saa/students/codeofconduct.php), the Code applies to conduct that occurs on the Campus, at LSU-sponsored activities, and/or when the Student or Registered Student Organization is representing LSU. The University shall have discretion to extend jurisdiction over conduct that occurs off campus when the conduct adversely and significantly affects the learning environment or University community and would be in violation of the Code if the conduct had occurred on campus. This includes behavior that may occur in a remote learning environment, such as email, discussion forums, zoom webinars, or any other platform or solution used for a course. In determining whether to extend jurisdiction, the University may consider its ability to gather information. Potential violations of the Code can be reported through [LSU Cares](https://www.lsu.edu/saa/lsu-cares/index.php).

**Postings on internet/ social networking sites**

Posting, releasing, or otherwise disclosing photos, identifiable descriptions, images, or records related to the educational or research activities pertaining to this course, outside of the LSU community via social networking sites (e.g. MySpace, Facebook, Twitter, etc.) or via other than standard professional means of query and/or dissemination of educational or research information is prohibited. This policy applies to all students, faculty, staff, and visitors of this course, on or off campus, as related to teaching and research in this course. This policy is to promote the safety and privacy of students, faculty, staff, and visitors. Failure to comply with this policy could result in damage to persons or property, may be a violation of legal, professional, and/or ethical obligations, and may result in disciplinary action by the LSU.

**Group work and unauthorized assistance**

All work must be completed without assistance unless the faculty member gives explicit permission for group or partner work. This is critical so that the professor can assess your performance on each assignment. If a group/partner project is assigned, the student may still have individual work to complete. Read the syllabus and assignment directions carefully. You might have a project with group work and a follow up report that is independently written. When in doubt, e-mail the faculty member or ask during a class session. Seeking clarification is your responsibility as a student. Assuming group/partner work is okay without permission constitutes a violation of the LSU Code of Student Conduct.

**Americans With Disabilities Act**

Louisiana State University is committed to providing reasonable accommodations for all persons with disabilities. The syllabus is available in alternate formats upon request.

**Students with disabilities:** If you are seeking classroom accommodations under the Americans with Disabilities Act, you are required to register with Disability Services (DS). DS is located in 115 Johnston Hall. Phone is 225/578-5919. To receive academic accommodations for this class, please obtain the proper DS forms and meet with me at the beginning of the class. The [Office of Disability Services](http://disability.lsu.edu/students) is available to help and answer the questions you might have.

**Syllabus Change Policy**

Except for changes that substantially affect the implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advanced notice.

**Copyright Statement​**

Some of the materials in this course are possibly copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act (Section 110(1) of the Copyright Act)​ ​<http://www.copyright.gov/docs/regstat031301.html>.