A picture containing object, clock, sitting, computer

Description automatically generated

**COURSE SYLLABUS**

College Name: College of Engineering

Department Name: Computational Science and Engineering

Course Name: Data Processing and Visualization

**COURSE INFORMATION**

* Course Number/Section: CSE 704
* Term:
* Semester Credit Hours: 3
* Times and Days:
* Class Location:

**INSTRUCTOR CONTACT INFORMATION**

* Instructor:
* Office Location:
* Office Phone:
* Email Address:

*Faculty must notify students of the approximate time and method they can expect to receive an answer to all communications (e.g., email, phone, course messages). Excluding holidays, the response should be provided within 48 hours.*

*If there is a graduate teaching assistant assigned to work with this course, please include their names(s).*

**STUDENT HOURS**

*These are times students may visit the professor without an appointment to request the assistance they need.*

*NOTE: Students are responsible for reading, understanding and following the syllabus.*

     :      AM  / PM  –      :      AM  / PM

Monday  Tuesday  Wednesday  Thursday  Friday

**COURSE PREREQUISITES**

None

**COURSE DESCRIPTION**

This course covers computational techniques for solving deterministic physical models in engineering and sciences, as well as computational techniques for non-deterministic models in business, economics, informatics, statistics, etc. It also involves a detailed study of visualization, analysis and interpretation techniques useful in the analysis of numerical data in both deterministic and non-deterministic disciplines, as well as visualization and interpretation software tools.

**STUDENT LEARNING OBJECTIVES/OUTCOMES (SLO)**

*Learning outcomes should be specific, measurable and focused on the content knowledge the students are expected to master and not what the faculty will teach.*

*If the course is a General Education Course, the SLO should be listed and labeled as “General Education.”*

1. Discuss and communicate about issues of using data, especially big data.
2. Formulate and solve problems with visualization on computational tools by practicing their critical thinking skills and actively learning and applying their knowledge.
3. Address practical challenges involving real-world data and include several case studies and hands-on work using languages and other tools.
4. Utilize methods and practices of handling data; this includes generating, loading, formatting, and processing data.
5. Use tools that provide the ability to employ multiple modes of inquiry in discussions and written responses to exercises and examinations, that are useful for conducting research in general.
6. Collaborate in project teams while working on course project(s) and enhancing their written and oral communication skills.

**REQUIRED TEXTBOOKS AND MATERIALS**

*Any course-level subscriptions and tools linked in Blackboard Learn learning management system (LMS) should be listed here. The Blackboard LMS must have links to their student data privacy statement.*

**REQUIRED TEXTS:**

Keim, D. (2010). *Mastering the information age solving problems with visual analytics*. Eurographics Association.

McKinney, W. (2017). *Python for data analysis, 2nd Edition* (2nd ). O'Reilly Media, Inc.

Vanderplas, J. T. (2017). *Python data science handbook: essential tools for working with data*. O'Reilly.

**REQUIRED MATERIALS:**

**SUGGESTED COURSE MATERIALS**

**SUGGESTED READINGS/TEXTS:**

**SUGGESTED MATERIALS:**

**GRADING POLICY**

**ASSIGNMENTS AND GRADING POLICY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 94% and above | A |  | 76% - 74% | C |
| 93% - 90% | A- |  | 73% - 70% | C- |
| 89% - 87% | B+ |  | 69% - 67% | D+ |
| 86% - 84% | B |  | 66% - 64% | D |
| 83% - 80% | B- |  | 63% - 0% | F |
| 79% - 77% | C+ |  |  |  |

**For GRADUATE COURSES:** See 2020-2021 Graduate Catalog p.38 for graduate grading scale and Non-Graded Courses

**GRADING ALLOCATION**

Course grades are based on a weighted grading scale of 100%. The breakdown for the course is as follows: *[Faculty, please adjust according to your course.]*

| Category | # of Activities | Percentage Grade Weight |
| --- | --- | --- |
| Discussion Board – Participation Problem Solving Activities | 4 | 5% |
| Homework Assignments / Quizzes | 5 | 20% |
| Class Project Abstract | 1 | 5% |
| Class Project Mid Report | 1 | 5% |
| Final Presentation | 1 | 10% |
| Final Project | 1 | 10% |
| Exams | 2 | 45% |
| Total | **15** | **100%** |

**COURSE POLICIES**

**USE OF BLACKBOARD AS THE LEARNING MANAGEMENT SYSTEM**

Blackboard is the primary online instructional and course communications platform. Students can access the course syllabus, assignments, grades, and learner support resources. Students are encouraged to protect their login credentials, complete a Blackboard orientation and log in daily to course.

**Note:** Uploading assignments through Blackboard presents a challenge for Chromebook users in locating the files for submission. If you use a Chromebook, please be sure you also have access to a Mac computer or Windows computer so you can fully participate in your Blackboard class. For more information about student computer recommendations, please visit

<https://hub.ncat.edu/administration/its/computer-recommendations.php>.

**MAKE-UP EXAMS**

*See* << Update Academic Year >>*Undergraduate Bulletin:*

[***https://www.ncat.edu/provost/academic-affairs/bulletins/index.php***](https://www.ncat.edu/provost/academic-affairs/bulletins/index.php)

**For GRADUATE STUDENTS:** See 2020-2021 Graduate Catalog p. 54

**EXTRA CREDIT**

**LATE WORK**

**SPECIAL ASSIGNMENTS**

**For GRADUATE STUDENTS:** **FAILING TO MEET COURSE REQUIREMENTS (Graduate Catalog p.40)**

**For GRADUATE STUDENTS:** **CLASS ATTENDANCE (see 2020-2021 Graduate Catalog p. 54-55)**

Students are expected to attend class and participate on a regular basis in order to successfully achieve course learning outcomes and meet federal financial aid requirements ([34 CFR 668.22](https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&sid=daca62a1bdeccf2ee0581ae5d11317c6&rgn=div8&view=text&node=34:3.1.3.1.34.2.39.12&idno=34)). Class attendance in online courses is defined as active participation in academically-related course activities. Active participation may consist of course interactions with the content, classmates, and/or the instructor. Examples of academically-related course activities include, but are not limited to:

* Completing and submitting assignments, quizzes, exams, and other activities within Blackboard or through Blackboard (3rd-party products).
* Participating in course-related synchronous online chats, discussions, or meeting platforms such as Blackboard Collaborate in which participation is tracked.

**CLASSROOM CITIZENSHIP**

Courtesy, civility and respect must be the hallmark of your interactions.

**COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT**

North Carolina A&T State University (N.C. A&T) is committed to following the requirements of the Americans with Disabilities Act Amendments Act (ADAAA) and Section 504 of the Rehabilitation Act.

If you need an academic accommodation based on the impact of a disability, you must initiate the request with the Office of Accessibility Resources (OARS) and provide documentation in accordance with the Documentation Guidelines at N.C. A&T. Once documentation is received, it will be reviewed. Once approved, you must attend a comprehensive meeting to receive appropriate and reasonable accommodations. If you are a student registered with OARS, you must complete the Accommodation Request Form to have accommodations sent to faculty.

OARS is located in Murphy Hall, Suite 01 and can be reached at 336-334-7765, or by email at [accessibilityresources@ncat.edu](mailto:accessibilityresources@ncat.edu). Additional information and forms can be found on the internet at <https://www.ncat.edu/provost/academic-affairs/accessibility-resources/index.php>.

**Please note:** Accommodations are not retroactive and begin once the Disability Verification Form is provided to faculty.

**TITLE IX**

North Carolina A&T State University is committed to providing a safe learning environment for all students—free of all forms of discrimination and harassment. Sexual misconduct and relationship violence in any form are inconsistent with the university’s mission and core values, violate university policies, and may also violate federal and state law. Faculty members are considered “Responsible Employees” and are required to report incidents of sexual misconduct and relationship violence to the Title IX Coordinator. If you or someone you know has been impacted by sexual harassment, sexual assault, dating or domestic violence, or stalking, please visit the Title IX website to access information about university support and resources <https://www.ncat.edu/legal/title-ix/index.php>. If you would like to speak with someone confidentially, please contact the Counseling Services at 336-334-7727 or the Student Health Center at 336-334-7880.

**TECHNICAL SUPPORT**

If you experience any problems with your N.C. A&T account, you may call Client Technology Services (formerly Aggie Tech Support and Help Desk) at 336-334-7195, or visit <https://hub.ncat.edu/administration/its/dept/ats/index.php>.

**FIELD TRIP POLICIES / OFF-CAMPUS INSTRUCTION AND COURSE ACTIVITIES**

*If applicable:*

Off-campus, out-of-state, and foreign instruction and activities are subject to state law and university policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at <https://www.ncat.edu/campus-life/student-affairs/index.php>.

**STUDENT HANDBOOK**

<https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php>

**STUDENT TRAVEL PROCEDURES AND STUDENT TRAVEL ACTIVITY WAIVER**

<https://hub.ncat.edu/administration/student-affairs/staff-resources/studen_activity_travel_waiver.pdf>

**OTHER POLICIES** *(e.g., Copyright Guidelines, Confidentiality, etc.)*

**STUDENT HANDBOOK**

<https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php>

[Graduate Catalog](https://www.ncat.edu/tgc/graduate-catalog/index.php)

**SEXUAL MISCONDUCT POLICY**

<https://www.ncat.edu/legal/title-ix/sexual-harassment-and-misconduct-policies/index.php>

**FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)**

<https://www.ncat.edu/registrar/ferpa.php>

**STUDENT COMPLAINT PROCEDURES**

<https://www.ncat.edu/current-students/student-complaint-form.php>

**STUDENT CONDUCT AND DISCIPLINE**

North Carolina A&T State University has rules and regulations that govern student conduct and discipline meant to ensure the orderly and efficient conduct of the educational enterprise. It is the responsibility of each student to be knowledgeable about these rules and regulations.

Please consult the following about specific policies such as academic dishonesty, cell phones, change of grade, disability services, disruptive behavior, general class attendance, grade appeal, incomplete grades, make up work, student grievance procedures, withdrawal, etc.:

* Undergraduate Bulletin

<https://www.ncat.edu/provost/academic-affairs/bulletins/index.php>

* Graduate Catalog

<https://www.ncat.edu/tgc/graduate-catalog/index.php>

* Student Handbook

<https://www.ncat.edu/campus-life/student-affairs/departments/dean-of-students/student-handbook.php>

**ACADEMIC DISHONESTY POLICY**

Academic dishonesty includes but is not limited to the following:

1. Cheating or knowingly assisting another student in committing an act of cheating or other academic dishonesty;
2. Plagiarism (unauthorized use of another’s words or ideas as one’s own), which includes but is not limited to submitting exams, theses, reports, drawings, laboratory notes or other materials as one’s own work when such work has been prepared by or copied from another person;
3. Unauthorized possession of exams or reserved library materials; destroying or hiding source, library or laboratory materials or experiments or any other similar actions;
4. Unauthorized changing of grades, or marking on an exam or in an instructor’s grade book or such change of any grade record;
5. Aiding or abetting in the infraction of any of the provisions anticipated under the general standards of student conduct;
6. Hacking into a computer and gaining access to a test or answer key prior to the test being given. N.C. A&T reserves the right to search the emails and computers of any student suspected of such computer hacking if a police report of the suspected hacking was submitted prior to the search; and
7. Assisting another student in violating any of the above rules.

A student who has committed an act of academic dishonesty has failed to meet a basic requirement of satisfactory academic performance. Thus, academic dishonesty is not only a basis for disciplinary action but may also affect the evaluation of a student’s level of performance. Any student who commits an act of academic dishonesty is subject to disciplinary action.

In instances where a student has clearly been identified as having committed an act of academic dishonesty, an instructor may take appropriate disciplinary action, including a loss of credit for an assignment, exam or project; or awarding a grade of “F” for the course, **subject to review and endorsement by the chairperson and dean**.

**For GRADUATE STUDENTS:** Reference for academic dishonesty – 2020-2021 Graduate Catalog, p.59

**For GRADUATE STUDENTS:** **STUDENT RELIGIOUS OBSERVANCE (see Graduate Catalog, p.55)**

**ASSIGNMENTS AND ACADEMIC CALENDAR**

Include topics, reading assignments, due dates, exam dates, withdrawal dates, pre-registration and registration dates, all holidays and convocations.\*

| The Week of MM/DD/YY | Subject | Unit Learning Objectives | Reading in  Text, activity, homework, exam |
| --- | --- | --- | --- |
|  | Unit 1: Introduction | ULO 1: Describe an overview of components of data analytics. (SLO 1)  ULO 2: Compare traditional data mining and information visualization. (SLO 1)  ULO 3: Explain computational thinking, data management, and data ingestion cycles. (SLO 2) | 1. **Read Textbook:** Keim, D. (2010). Mastering the information age solving problems with visual analytics. Eurographics Association.   1. Chapter 3: Data Management of Solving Problems with Visual Analytics 2. Chapter 4: Data Mining of Solving Problems with Visual Analytics |
|  | Unit 2: Generating and Loading Data | ULO1: Explain effectively load, store and manipulate in-memory data. (SLO 3) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly. 2. Chapter 2: Data Manipulation with Pandas of Python Data Science Handbook   2. **Read Textbook:**  McKinney, W. (2017). Python for Data Analysis, 2nd Edition (2nd ). O'Reilly Media, Inc.   1. Chapter 6: Data Loading, Storage, and File Formats   3. **Complete:** Assignment #1 (ULO 1) |
|  | Unit 3: Cleaning, Handling Missing Data | ULO 1: Explain data structure provided by the library. (SLO 2)  ULO 2: Imput missing data. (SLO 3)  ULO 3: Explore real-world examples of imputation (SLO 3) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly.   1. Chapter 2: Data Manipulation with Pandas of Python Data Science Handbook |
|  | Unit 4: Verifying Data | ULO 1: Explain built-in data structure, function, and files. (SLO 4)  ULO 2: Participate in the discussion board. (SLO 6)  ULO 3: Submit the project abstract. (SLO 5) | 1. **Read Textbook:** McKinney, W. (2017). Python for Data Analysis, 2nd Edition (2nd ). O'Reilly Media, Inc. 2. Chapter 7: Data Cleaning and Preparation 3. **Complete:** Discussion Board #1 (ULO 2) 4. **Complete**: Assignment #2 (ULO 1) 5. **Complete:** Project Abstract (ULO 3) |
|  | Unit 5: Formatting Data | ULO 1: Use tools with array-oriented semantics effectively. (SLO 5) | 1. **Read Textbook:** McKinney, W. (2017). Python for Data Analysis, 2nd Edition (2nd ). O'Reilly Media, Inc.    1. Chapter 4: NumyPy Basics: Arrays and Vectorized Computation |
|  | Unit 6: Describing Data; Hierarchical Indexing | ULO 1: Incorporate multiple index levels within a single index (SLO 4) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly.    1. Chapter 3: Data Manipulation with Pandas of Python |
|  | Unit 7: Combining Datasets: Concat, Append, Merge, Join | ULO 1: Combine different data sources (SLO 4) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly.    1. Chapter 3: Data Manipulation with Pandas of Python |
|  | Unit 8: Aggregation and Grouping, Pivot Tables | ULO 1: Explore Aggregations from simple operations to more sophisticated operations. (SLO 4)  ULO 2: Complete the Midterm Exam. (SLO 5) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly.    1. Chapter 3: Data Manipulation with Pandas of Python 2. **Complete:** Midterm Exam (ULO2) |
|  | Unit 9: Time Series Data and Visualization | ULO 1: Address data with dates, times, and time indexed data. (SLO 4)  ULO 2: Analyze and describe data components changing by time. (SLO 6) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly.   1. Chapter 3: Data Manipulation with Pandas of Python   2. **Complete:** Class  Project Mid Report #1  (ULO 2) |
|  | Unit 10: Basis Algorithms, Data Types, and Visualization | ULO 1: Preform mathematical operations on whole blocks of data. (SLO 4) | 1. **Read Textbook:** McKinney, W. (2017). Python for Data Analysis, 2nd Edition (2nd ). O'Reilly Media, Inc. 2. Chapter 4: NumyPy Basics: Arrays and Vectorized Computation |
|  | Unit 11: Line Plots, Scatter Plots, Visualizing Errors, Vectorized String; Histograms, Binnings, and Density | ULO 1: Display various plots (SLO 4)  ULO 2: Adjust plots interactively. (SLO 4) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly.    1. Chapter 4: Visualization with Matplotlib |
|  | Unit 12: Customizing Plot Legends, Colorbars, Subplots; Text and Annotation | ULO 1: Customize labeled plot elements. (SLO 4) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly.    1. Chapter 4: Visualization with Matplotlib 2. **Complete:** Assignment #3 (ULO 1) |
|  | Unit 13: Three-Dimensional Plotting, Geographic Data | ULO 1: Create and analyze the three-dimensional data. (SLO 4)  ULO 2: Visualize geographical data science. (SLO 4) | 1. **Read Textbook:** Vanderplas, J. T. (2017). Python data science handbook: essential tools for working with data. O'Reilly.    1. Chapter 4: Visualization with Matplotlib 2. **Complete:** Discussion Board #2 (ULO 1-2) |
|  | Unit 14: Exploratory Data Analysis | ULO 1: Examine the difference and define the idea of Explanatory vs. Exploratory data analysis. (SLO 4)  ULO 2: Complete the Final Presentation (SLO 6) | 1. **Read Article:** Real-time Prediction of Secondary Incident Occurences Using Vehicle Probe Data 2. **Complete:** Final Presentation (ULO 2) |
|  | Unit 15: Spatio-Temporal Visual Analytics | ULO 1: Review course materials and prepare for the final exam. (SLO 4)  ULO 2: Mark and analyze time-series correlations. (SLO 4)  ULO 3: Complete Exam #2. (SLO 6)  ULO 4: Complete the Final Report. (SLO 5) | 1. **Read Article:** Real-time Prediction of Secondary Incident Occurences Using Vehicle Probe Data 2. **Complete:** Exam #2 (ULO 3) 3. **Complete:** Final Report (ULO 4) |

*\* These descriptions and timelines are subject to change at the discretion of the instructor.*