# North Carolina Agricultural and Technical State University

# College of Engineering

# Department of Computational Science and Engineering

# CSE 708: Applications of Data Analytics and Eng’g

### Course Syllabus

## Course Information

|  |  |  |
| --- | --- | --- |
| Course Number/Section: | CSE 708-01 |  |
| Term: | Fall 2020 |  |
| Semester Credit Hours: | 3 |  |
| Times and Days: | TBA |  |
| Class Location: | TBA |  |

## Instructor Contact Information

|  |  |  |  |
| --- | --- | --- | --- |
| Instructor | Dr. Balu Gokaraju | |  |
| Office Location | Fort IRC 305, 3rd Floor |  | |
| Office Phone | 336-285-3210 | |  |
|  |  | |  |
| Email Address | bgokaraju@ncat.edu | |  |

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## Student Hours: 10:00 – 12:00 PM M/W/F. These are times you may visit your professor without an appointment to request the assistance that you need. Please email me for any other meeting times.

## Note: Students are responsible for reading, understanding, and following their syllabi.

**Course Pre-requisites:** **CSE700/CSE620:** Introduction to Computational Science or

Intro to Computational Software Tools, or equivalent course or Permission of the instructor.

**Course Description :** This is a project-based learning course, where the students will

consider the challenges, issues, and approaches of Data Analytics and Engineering and its application in the field of business, e-commerce, bioinformatics, social media, intelligent transportation, and image and video libraries..

**SACS and ABET Student Learning Objectives/Outcomes**

SACS Outcomes:

1. Will gain knowledge in theory and practice of Data Analytics Challenges (Data ingestion cycle, the 5Vs (Velocity, Volume, Value, Variety, and Veracity), Provenance, structures and formats, Legacy Data, Media, Hardware and software requirements, Impact)
2. Will gain kowledge in theory and practice of Data Analytics Approaches: (Relational and sequential databases, Preprocessing, Machine Learning, Expert systems, AI, computational Statistics, Exploration, Optimization, and Visualization)
3. Will gain the experiential learning by demonstrating the skills gained in any of the relevant Application projects given below:

Business Decisions and E-Commerce

Bioinformatics

Image, Audio, and Video processing

GIS and intelligent transportation systems

Social Media

1. Will demonstrate the analysis and discussion regarding the Project-Based Learning
2. Will demonstrate the Ethical and Societal Considerations in the Project-Based learning.

**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”.**

ABET Outcomes:

**Required Textbooks and Materials**

*Required Texts:*

Machine Learning Mastery With Python Understand Your Data, Create Accurate Models and work Projects End-to-End by *Author Jason Brown Lee*

*Required Materials:*

The course materials will be supplemented by additional reading on application of data mining to satellite Remote Sensing. This reading material will be handed out in class.

**Suggested Course Materials**

*Suggested Readings/Texts:*

* + Data Mining: Concepts and Techniques, The Morgan Kaufmann series in Data Management Systems, Jiawei Han, Micheline Kamber and Jian Pei, Publishers, ISBN 978-0-12-381479-1
  + Statistical Pattern Recognition, Third Edition, Wiley, Andrew Webb and Keith D. Copsey, ISBN 978-0-470-68227-2
  + Hands-on Machine Learning with Scikit-Learn & Tensorflow

*Suggested Materials:*

You will be expected to read and review articles from journals/books related to the topic of discussion.

**Grading Policy**

## Assignments and Grading Policy

**(Example: use your table)**

|  |  |  |  |
| --- | --- | --- | --- |
| 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% - 60% | D- |
| 79% - 77% | C+ | 60% - 00% | F |

**Grading Allocation**

Course grades are based on a weighted grading scale of 100%. The breakdown for the course is as follows:

**(Example: use your table)**

|  |  |  |  |
| --- | --- | --- | --- |
| TYPE | Numer of | Points | Total Points |
| Assignments | **5** | **50** | **250 (25%)** |
| Midterm | **1** | **150** | **15 (15%)** |
| Final Exam | **1** | **200** | **20 (20%)** |
| Class Participation | **10** | **10** | **100 (10%)** |
| Class Final Project | **1** | **300 (200 for Report and 100 for Presentation)** | **300 (30%)** |
| Total Sum |  |  | **1000 (100%)** |

**Course Policies**

***Use of Blackboard as the Learning Management System***

Blackboard is the primary platform for instructor announcements, access to the syllabus and graded assignments. Students are expected to access Blackboard daily for pertinent information regarding the course.

***Make-up exams***

*Consult me for permittable excused absence and assigning a make up exam*

See 2018-2019 Undergraduate Bulletin:

<http://www.ncat.edu/divisions/academic-affairs/bulletin/2018-2019/>

***Extra Credit***

***Late Work***

*You will be penalized 10% of the assigned points for each late submission*

***Special Assignments***

***Class Attendance***

It is University policy and my expectation that you will attend class. Poor class attendance results in poor grade performance. Make-up examinations will be given in accordance with University policy (2017-2018 Undergraduate Bulletin).

***Classroom Citizenship****:* Courtesy, civility and respect must be the hallmark of your interactions.

***Compliance with the Americans with Disabilities Act*   
N**orth Carolina A&T State University is committed to complying with the Americans with Disabilities Act of 1990 and Section 504 of the Rehabilitation Act of 1973 by providing equal access to the programs, services and benefits to qualified students with disabilities. All reasonable efforts must be made to accommodate the needs of students with documented disabilities. **If a student has a disability that qualifies under the American with Disabilities Act Amendments Act (ADAAA) and requires accommodations, he/she should contact or visit the Office of Accessibility Resources (OAR) located in Murphy Hall, Suite 01 or at (336) 334-7765 for information on appropriate policies and procedures. Disabilities covered by ADA may include learning, psychiatric, physical disabilities, or chronic health disorders. Students can contact the Office of Accessibility Resources if they are not certain whether a medical condition/disability qualifies.** ***Please note that approved accommodations must be adhered to by law, but cannot be performed retroactively!***

***Title IX***

North Carolina A&T State University is committed to providing a safe learning environment for all students, is 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. If you would like to speak with someone confidentially, please contact the Counseling Services or Student Health Center.

***Technical Support***

If you experience any problems with your A&T account you may call Aggie Tech Support (formerly Help Desk) at 336.334.7195 or <http://www.ncat.edu/divisions/its/dept/ats/>

***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:*

***Student Affairs website*** <http://www.ncat.edu/student-affairs/index.html>

***Student Handbook:*** [***http://www.ncat.edu/student-affairs/student-services/dean/student-handbook.html***](http://www.ncat.edu/student-affairs/student-services/dean/student-handbook.html)

***Student Travel Procedures and Student Travel Activity Waiver*** [***http://www.ncat.edu/student-affairs/division-assets/downloads/information/studen\_activity\_travel\_waiver.pdf***](http://www.ncat.edu/student-affairs/division-assets/downloads/information/studen_activity_travel_waiver.pdf)

*Description of any travel and/or risk-related activity associated with this course.*

**Other Policies (e.g., copyright guidelines, confidentiality, etc.)**

***Student Handbook*** [***http://www.ncat.edu/student-affairs/student-services/dean/student-handbook.html***](http://www.ncat.edu/student-affairs/student-services/dean/student-handbook.html)

***Sexual Misconduct Policy*** [***http://www.ncat.edu/student-affairs/student-services/dean/sexual-misconduct.html***](http://www.ncat.edu/student-affairs/student-services/dean/sexual-misconduct.html)

***Family Educational Rights and Privacy Act*** [***http://www.ncat.edu/registrar/ferpa/***](http://www.ncat.edu/registrar/ferpa/)

***Student Complaint Procedures:*** [***http://www.ncat.edu/student-affairs/student-resources/student-complaint-form.html***](http://www.ncat.edu/student-affairs/student-resources/student-complaint-form.html)

***Student Conduct & 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 undergraduate bulletin: <http://www.ncat.edu/divisions/academic-affairs/bulletin/2018-2019/index.html>, graduate bulletin: <http://www.ncat.edu/tgc/graduate-catalog/2018-2019/NCAT%20Graduate%20Catalog%202017-18.pdf> , and Student Handbook [***http://www.ncat.edu/student-affairs/student-services/dean/student-handbook.html***](http://www.ncat.edu/student-affairs/student-services/dean/student-handbook.html)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.

***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;

| **Month** | **Day** | **Subject** | **Module Learning Outcomes (mapped CLO#s)** | **Themes for Modules** | **Assignemnts Homework, (due every Wednesday)** |
| --- | --- | --- | --- | --- | --- |
| Aug | 21 | 1. Data Analytics Challenges: Data Ingestion Cycle, Data Optimization | Will get introduced to Data Science Fundamentals and Terminology (CLO**#**1) | Familiarize about Big Data Science |  |
| Aug | 28 | 1. Data Provenance, Data Structures, Data Exploration and Formats | Will identify the Big Data Analytics Terminology and advantages (CLO**#**1) | Basics of BIG DATA Analytics | Assignment-1 |
| Sep | 4 | 1. Legacy Data, Media, Hardware and Software requirements and impact of HPC | Will categorize the BIG DATA Standard Formats used in Sotware Tolos  (CLO**#**2) | Formats of BIG DATA | Assignment-2 |
| Sep | 11 | 1. Data Analytics approaches: (Relational and sequential databases, Preprocessing, Computational Statistics, and Data Visualizations) | Will recognize the Big Data Mining Software Tools and practice the skills  (CLO**#**2) | BIG DATA MINING Tools |  |
| Sep | 18 | 1. Machine Learning, Expert Systems, AI, | Gain hands-on Practice with Machine Learning Techniques (CLO#4) | Machine Learning (ML)Techniques | Assignment-3 |
| Sep | 25 | 1. Applications Projects1: Business Analytics and E-commerce | Data Analytics Application for Increase in Revenue and Sales (CLO#3) | Business Data Analytics |  |
| Oct | 2 | 1. Applications Projects2: Bio-informatics, Image, Audio, and Video Processing | Data Visualizations for numeric, image and video datasets . (CLO#3) | Bio/Health Data Analytics, Images and Video Classification | Assignment-4 |
| Oct | 9 | 1. **Mid-Term Exam** |  | Exam on Modules 1-7 |  |
| Oct | 16 | 1. Applications Projects3: GIS and Intelligent transportation systems, andSocial Media Analytics | Will Develop Classification, Clustering, and Regression Models using ML Techniques (CLOs#3 and 4) | BIG DATA Mining and Analytics on Satellite Remote Sensing Datasets, and on Social Media Datasets | Assignment-5 |
| Oct | 23 | 1. Ethical and Societal Parameters | Will classify the ethical, fairness, inclusiveness of the Data Sharing Concepts (CLO#5) | Ethics of using Public or Private Datasets |  |
| Nov | 6 | 1. Class Project Discussion | Identify the Problem Description and Literature Review for Class Project of their choice (CLOs#3,4,5) | Class Project Phase-1 submission | Class Project Phase-1 submission |
| Nov | 13 | 1. Class Project Presentation | Identify the Datasets, experiments, methodology Process, and produce Results (CLOs#3,4,5) | Class Project Phase-2 submission | Class Project Phase-2 submission |
| Nov | 16 | 1. Class Project Presentation | Discuss their findings based on the Results and write a 4-Page IEEE format (CLOs#3,4,5) | Class Project Phase-3 and 4 submission | Class Project Submission |
| Nov | 18 | 1. **Final Exam** | Comprehensive understanding of the Data Analytics and Engineering | Exam on Modules 1-13 |  |
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1. Aiding or abetting in the infraction of any of the provisions anticipated under the general standards of student conduct;
2. Hacking into a computer and gaining access to a test or answer key prior to the test being given. 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
3. 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****.*

**Assignments & Academic Calendar**

*Topics, Reading Assignments, Due Dates, Exam Dates, Withdrawal Dates, Pre-registration and Registration Dates, all Holidays, and Convocations.*

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

**Welcome MESSAGE to the Course in Week 1 :**

This is a project-based learning course, where the students will consider the challenges, issues, and approaches of Data Analytics and Engineering and its application in the field of business, e-commerce, bioinformatics, social media, intelligent transportation, and image and video libraries..

The literal meaning of ‘Big Data’ seems to have developed a myopic understanding in the minds of aspiring big data enthusiasts. When asked people about Big Data, you here response that it requires high computations resources to handle the data management and complex understanding of mining the Big DATA. Big Data, is not just about, storing and extracting data, but much more than that. Big Data, itself comprises of so many technologies that it is difficult to know the point to start just from googleing. Some of the technologies big data consists of is Hadoop, MapReduce, Apache, Pig, Hive, Flume, Sqoop, Zookeeper, Oozie, Spark, Cassandra, Mongo DB and Companies are desperately in search of skilled big data analysts. Considering the fact, that data is being collected and stored at a velocity faster than ever, the urgency of such skilled professionals increases further. By the end of this course you will gain the skills to handle the BIG DATA Mining, Analysis, and developing the machine Learning Models for prediction using BIG DATA. You will experience applying these skills in fields of Business Analytics, Bio-Informtics, GIS and Satellite Remote Sensing, and Social Media Datasets.