ECE 4150 Syllabus

**[Cloud Computing, 2-3-3]**

**[Class Day(s), Time, Location (include lab/recitation locations)]**

**Instructor Information**

|  |  |  |
| --- | --- | --- |
| **Instructor** | **Email** | **Office Hours & Location** |
| Vijay Madisetti | vkm@gatech.edu | [Location, Hours, Days] |
| **Teaching Assistant(s)** | **Email** | **Office Hours & Location** |
| [TA Name] | [Email address] | [Location, Hours, Days] |

**General Information**

**Description**

The course covers basic technologies that form the foundations of cloud computing. These include topics such as virtualization, load balancing, scalability & elasticity, deployment, replication. Real-world examples of cloud-based services and their characteristics will be covered. Programming aspects of cloud computing with a view towards rapid prototyping complex applications will be covered. Reference architectures for different classes of cloud applications, including e-Commerce, Business-to-Business, Banking, Retail and Social Networking in the context of commonly used design methodologies will be examined in detail. Specialized aspects of cloud computing including cloud application benchmarking, applications, cloud security and big data analytics will be covered.

## Pre- &/or Co-Requisites

ECE 2036 with a minimum grade of C

## Course Educational Objectives and Outcomes

**Objectives: Students will…**

1. Apply their knowledge of engineering and mathematics to analyze different cloud computing frameworks
2. Demonstrate their ability to design a computing system to meet realistic constraints for manufacturability
3. Utilize their earlier coursework and acquired expertise to complete a team-based major design project.
4. Engage in both formal and informal written and oral professional communication exercises.
5. Demonstrate an ability to utilize basic tools and techniques necessary for engineering praxtice of cloud application design.

**Outcomes: Upon successful completion of this course, students should be able to…**

1. Understand what is cloud computing and its architecture.
2. Develop and design applications for cloud computing
3. Design & port applications to Amazon, Microsoft and Google’s Cloud Platforms
4. Optimize and enhance cloud applications for performance, security and scalability
5. Develop and implement robust case studies for further study and analysis.

**Course Requirements & Grading**

* 1. Lab assignments - 25%
  2. Midterm – 30%
  3. Project – 15%
  4. Final – 30%

Note: 40% of your aggregate grade score will be known by the course drop date.

Note: 70% of your aggregate grade score will be known by the date of the Final exam.

**Description of Graded Components**

The course will include 6 labs which will be done on an individual basis. Each lab will count as 4% of the final grade and students are expected to spend 4-8 hours on each lab. The project will count as 15% of the grade and will be done in teams of 5-6 students. Students will get 3 weeks to complete the project. As part of the project, the teams will be required to present a project proposal, a preliminary design review (PDR) presentation, and a critical design review (CDR) presentation. There will be a midterm exam and a final exam each counting as 30% of the course grade.

**Grading Scale**

Grading will be done on a curved basis, with typical ranges shown. Instructor retains the flexibility to make minor adjustments.

|  |  |  |
| --- | --- | --- |
| **Grade** | **Typical Percentage of Students** | **Typical aggregate score** |
| **A** | **30%** | **86-100%** |
| **B** | **40%** | **75-85%** |
| **C** | **10%** | **51- 74%** |
| **D** | **10%** | **30-50%** |
| **F** | **10%** | **0-29%** |

**Course Materials**

**Course Text**

**Cloud Computing: A Hands-On Approach,** ISBN-978-1494435141, Arshdeep Bahga, Vijay Madisetti, 2013

## Additional Materials/Resources

Lecture slides will be available through T-Square

## Course Website and Other Classroom Management Tools

T-Square will be used for course management and Piazza forums for course discussions.

**Course Expectations & Guidelines**

## Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

## Accommodations for Individuals with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

## Assignment Turn-In

Assignments will be released on T-Square and students will be required to upload their submissions on T-Square before the assignment deadlines.

## Attendance and/or Participation

* Attendance or participation in lectures will not be graded.
* Attendance in project presentations is mandatory.

## Collaboration & Group Work

* Lab assignments are expected to be done individually without any collaboration.
* Projects will be done in teams, however teams will need to specify individual contributions in the project reports.

## Extensions, Late Assignments, & Re-Scheduled/Missed Exams

* Late submissions will be subject to a penalty of 50%.
* Students can seek lab extensions to cover for “approved Institute activities” (see http://www.catalog.gatech.edu/rules/4/ for more information)

## Student-Faculty Expectations

At Georgia Tech we believe that it is important to continually strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectations – that you can have of me, and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech, while in this class.

**Course Schedule**

* **Part I: Weeks 1-4**

Covers and introduction to cloud computing and the basic technologies that form the foundations of cloud computing.

* + Characteristics of cloud computing
  + Cloud deployment models
  + Cloud service models
  + Virtualization
  + Load balancing
  + Scalability & elasticity
  + Deployment
  + Replication
  + Monitoring
  + Identity and access management
  + Software Defined Networking
  + Network Function Virtualization
  + OpenFlow
  + Computing services
  + Storage services
  + Database services
  + Application services
  + Analytics services
  + Queuing & Messaging services
  + Network services
  + Deployment services
  + Hadoop &MapReduce
  + MapReduce Schedulers
* **Part II: Weeks 5-10**

Covers programming aspects of cloud computing with a view towards rapid prototyping complex applications.

* + Design Considerations for Cloud Applications
  + Reference Architectures for Cloud Applications
  + Cloud Application Design Methodologies – IaaS&PaaS approaches
  + Service Oriented Architecture
  + Cloud Component Model
  + Model View Controller
  + RESTful Web Services
  + SQL & No-SQL Data Storage Approaches
  + Introduction to Python
  + Python packages of interest for cloud
  + Python for Amazon Web Services
  + Python for Google Cloud Platform
  + Python for Windows Azure
  + Python for MapReduce
  + Python web application framework - Django
  + Developing cloud applications with Django
  + Cloud application case studies
* **Part III: Weeks 11-16**

Covers specialized aspects of cloud computing including cloud application benchmarking, multimedia cloud applications, cloud security and big data analytics.

* + Big Data characteristics
  + Clustering big data
  + Classification of big data
  + Recommendation systems
  + Apache Mahoutfor big data analytics
  + Real-time data analytics with Apache Storm
  + Cloud Application Benchmarking & Tuning
  + Performance testing approaches
  + Reference architectures for multimedia cloud
  + Cloud security considerations – authentication, authorization, identity management
  + Case studies on cloud for energy systems, industry, healthcare & education

**Suggested Labs & Exams**

* **Lab-1:** Weeks 2-3
  + Student account setups on AWS, Google Cloud, Windows Azure
  + Deploying multi-tier e-Commerce benchmark app on these clouds with load balancing
  + Performance comparison with horizontal and vertical scaling
* **Lab-2:** Week 4-5
  + MapReduce programming assignment
  + Comparison of Hadoop schedulers
* **Lab-3:** Week 6-7
  + Designing a REST-ful web service with Python &Django
* **Midterm Exam:** Weeks 8
* **Lab-4:** Week 9-10
  + Lab assignment on social media sentiment analysis
* **Lab-5:** Week 11-12
  + Lab assignment on Big Data analytics with Python & Mahout
* **Lab-6**: Week 13-14
  + Lab assignment on cloud benchmarking
* **Final Exam: After Week 16**

**02-21**