FLORIDA ATLANTIC UNIVERSITY

CEN 5086-001 15281

Cloud Computing

Date: Saturday 10:00 AM - 12:50 PM

Building: General Classroom South Boca **Room:** 120

3 Credit(s)

Spring 2024 - 1 Full Term

Instructor Information

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Office Hours: Briefly before and after class

Phone: None

TA Name:
Office:
Office Hours:
Telephone:
Email:

Course Description

Cloud Computing
Prerequisite: Graduate standing
Study of cloud computing and the use and architecture of this model of computation. Exploration of the services provided by clouds, their internal structure and their possibilities and limitations.

Instructional Method: In-person class and attendance is not mandatory.

Cloud Computing - Prerequisite: Graduate standing

Required Texts/Materials: No Text Required

Required Texts/Materials

No textbook required

Course Objectives/Student Learning Outcomes

Core topics that will be covered.

Google Cloud Platform (GCP)

- Overview of GCP Services: Cover core services like Compute Engine, App Engine, Kubernetes Engine, and BigQuery. Explain how they integrate and their use cases.
- Machine Learning and AI with GCP: Focus on AI and machine learning services like AutoML, AI Platform, and TensorFlow on GCP, showcasing real-world applications.
- GCP's Approach to Security: Discuss GCP's security model, compliance, and data protection features.
- Case Studies: Present case studies of businesses that have successfully implemented GCP solutions, highlighting the benefits and challenges.

Amazon Web Services (AWS)

- AWS Core Services Overview: Cover essential services like EC2, S3, RDS, and Lambda, explaining how they work together.
- AWS for Enterprise Solutions: Discuss how AWS supports large-scale enterprise needs, focusing on scalability, security, and reliability.
- Innovations in Cloud Computing with AWS: Highlight AWS's role in driving innovation, such as serverless computing and its IoT platform.
- AWS Case Studies: Analyze various successful AWS deployments, focusing on different industries to show versatility.

Microsoft Azure

- Introduction to Azure's Capabilities: Cover fundamental Azure services like Azure Virtual Machines, Azure Functions, and Azure Cosmos DB.
- Azure for Hybrid Cloud Solutions: Explain Azure's strengths in supporting hybrid cloud environments, including Azure Stack and Azure Arc.
- Azure's Integration with Microsoft Ecosystem: Discuss how Azure integrates with other Microsoft products and services, such as Office 365 and Dynamics 365.

- Azure Case Studies: Present examples of how different organizations use Azure, highlighting unique implementations.

Faculty Rights and Responsibilities

Florida Atlantic University respects the rights of instructors to teach and students to learn. Maintenance of these rights requires classroom conditions that do not impede their exercise. To ensure these rights, faculty members have the prerogative to:

• Establish and implement academic standards.

• Establish and enforce reasonable behavior standards in each class.

• Recommend disciplinary action for students whose behavior may be judged as disruptive under the Student Code of Conduct University Regulation 4.007.

Disability Policy

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

Course Evaluation Method

- Group Projects and Presentations (50% of Total Grade): It assesses your ability to collaborate effectively on a group project, the quality of research conducted, and the effectiveness of the presentation delivered as a team.
- Alternative Assessment Options (50% of Total Grade): In addition to group presentations, students have the option to undertake either an independent research paper or a practical cloud computing project, each constituting 50% of their overall grade. This flexibility allows students to choose a path that aligns with their interests and career goals, encouraging a deeper engagement with the subject matter.

Code of Academic Integrity

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes

with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001.

Attendance Policy Statement

Students are expected to attend all their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations, or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances, and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

Religious Accommodation Policy Statement

In accordance with the rules of the Florida Board of Education and Florida law, students have the right to reasonable accommodations from the University in order to observe religious practices and beliefs regarding admissions, registration, class attendance, and the scheduling of examinations and work assignments. University Regulation 2.007, Religious Observances, sets forth this policy for FAU and may be accessed on the FAU website at www.fau.edu/regulations.

Any student who feels aggrieved regarding religious accommodations may present a grievance to the executive director of The Office of Civil Rights and Title IX. Any such grievances will follow Florida Atlantic University's established grievance procedure regarding alleged discrimination.

Time Commitment Per Credit Hour

For traditionally delivered courses, not less than one (1) hour of classroom or direct faculty instruction each week for fifteen (15) weeks per Fall or Spring semester, and a minimum of two (2) hours of out-of-class student work for each credit hour. Equivalent time and effort are required for Summer Semesters, which usually have a shortened timeframe. Fully Online courses, hybrid, shortened, intensive format courses, and other non-traditional modes of delivery will demonstrate equivalent time and effort.

Course Grading Scale

Letter Grade	Letter Grade
A	94 - 100%
A-	90 - 93%
B+	87 - 89%
B	83 - 86%
B-	80 - 82%
C+	77 - 79%
C	73 - 76%
C-	70 - 72%
D+	67 - 69%
D	63 - 66%
D-	60 - 62%
F	Below 60

Grade Appeal Process

You may request a review of the final course grade when you believe that one of the following conditions apply:

• There was a computational or recording error in the grading.

• The grading process used non-academic criteria.

• There was a gross violation of the instructor's own grading system.

University Regulation 4.002 of the University Regulations contains information on the grade appeals process

Policy on Make-up Tests, Late work, and Incompletes

Late work not accepted

Policy on the Recording of Lectures

Students enrolled in this course may record video or audio of class lectures for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a

university course intended to present information or teach students about a particular subject. Recording class activities other than class lectures, including but not limited to student presentations (whether individually or as part of a group), class discussion (except when incidental to and incorporated within a class lecture), labs, clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, and private conversations between students in the class or between a student and the lecturer, is prohibited. Recordings may not be used as a substitute for class participation or class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct and/or the Code of Academic Integrity.

Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau.edu/counseling/

Student Support Services and Online Resources

- Center for Learning and Student Success (CLASS)
- Counseling and Psychological Services (CAPS)
- FAU Libraries
- Math Learning Center
- Office of Information Technology Helpdesk
- Center for Global Engagement
- Office of Undergraduate Research and Inquiry (OURI)
- Science Learning Center
- Speaking Center
- Student Accessibility Services
- Student Athlete Success Center (SASC)
- Testing and Certification
- Test Preparation
- University Academic Advising Services
- University Center for Excellence in Writing (UCEW)

- Writing Across the Curriculum (WAC)

Course Topical Outline

Lecture Organization

In this course, we will explore the intricacies of three major cloud platforms: Google Cloud Platform (GCP), Amazon Web Services (AWS), and Microsoft Azure. Our lectures are systematically structured to incorporate presentations from teams focusing on each of these platforms. The course is organized into a series of lectures, with each session dedicated to a specific aspect of one of these cloud platforms.

Each team will be responsible for preparing and delivering comprehensive presentations on their respective cloud platforms, ensuring a detailed and practical understanding of these technologies.

Week 1: Introduction to Cloud Computing

- Lecture 1: Basics of Cloud Computing
    - An overview of cloud computing, including its definition, key characteristics like scalability and elasticity, and types of cloud services (IaaS, PaaS, SaaS). Discuss the historical evolution of cloud computing and its impact on modern IT infrastructure.

Week 2: Introduction to Major Cloud Platforms

- Lecture 2: Overview of GCP, AWS, and Azure
    - Overview of each major cloud platform, highlighting their founding, market position, and unique selling propositions. Explain the significance of cloud platforms in the current technology landscape.

Week 3: GCP - Core Services

- Presentation 3: Introduction to GCP Services (GCP Team) - Present an overview of key services offered by Google Cloud Platform, like Google Compute Engine, Google App Engine, and their use cases in different industries.
- Introduction to Core GCP Services (40 minutes)
    - Compute Engine (10 minutes): Detailed introduction, features, and a complex use case.
    - App Engine (10 minutes): In-depth overview, unique benefits, and an example of real-world application.

    - Kubernetes Engine (10 minutes): Detailed explanation of GCP’s container management system, including a practical use-case scenario.
    - BigQuery (10 minutes): Comprehensive look at its capabilities in handling big data and an analysis of a specific case study.
- Industry-Specific Applications of GCP (40 minutes)
    - Retail Industry (10 minutes): How GCP services like BigQuery and Kubernetes Engine are used in retail for inventory management, customer data analytics, etc.
    - Healthcare Industry (10 minutes): Use of GCP in healthcare, focusing on patient data management, research collaborations, and telemedicine solutions.
    - Financial Services (10 minutes): Exploring GCP’s role in finance, such as in risk analysis, fraud detection, and high-speed transaction processing.
    - Manufacturing Sector (10 minutes): Application of GCP in manufacturing, including supply chain optimization, predictive maintenance, and IoT implementations.

Week 4: AWS - Core Services

- Presentation 4: Introduction to AWS Services (AWS Team) - Provide a general introduction to Amazon Web Services, covering essential services such as EC2, S3, and AWS Lambda, and their roles in cloud computing.
    - Introduction to Core AWS Services (40 minutes)
        - EC2 (Elastic Compute Cloud) (10 minutes): Detailed introduction to EC2, its features, and a complex use case demonstrating its flexibility and scalability.
        - S3 (Simple Storage Service) (10 minutes): In-depth overview of S3, its key functionalities, and an example of how it is used for data storage and management in real-world scenarios.
        - AWS Lambda (10 minutes): Comprehensive explanation of serverless computing with AWS Lambda, including practical use-cases and benefits.
        - RDS (Relational Database Service) (10 minutes): Detailed discussion on RDS, its role in database management, and an analysis of a specific implementation.
    - Industry-Specific Applications of AWS (40 minutes)
        - Media and Entertainment (10 minutes): Exploring AWS's role in streaming services, content delivery, and digital media transformation.
        - E-commerce (10 minutes): Use of AWS in online retail, focusing on web hosting, customer data analytics, and scalable infrastructure solutions.
        - Healthcare and Life Sciences (10 minutes): Discussing AWS's impact on healthcare, including patient data management, research collaborations, and telehealth applications.

        - Financial Services (10 minutes): AWS in the finance sector, covering aspects like security, compliance, and the use of cloud services in banking and insurance.

Week 5: Azure - Core Services

- Presentation 5: Introduction to Azure Services (Azure Team) - Introduce Microsoft Azure, focusing on its core services like Azure Virtual Machines and Azure SQL Database, and their uses in various business scenarios.
    - Introduction to Core Azure Services (40 minutes)
        - Azure Virtual Machines (10 minutes): Detailed introduction to Azure VMs, their features, and a complex use case demonstrating their use in cloud computing environments.
        - Azure SQL Database (10 minutes): In-depth overview of Azure SQL Database, its key functionalities, and an example of its application in data management.
        - Azure Functions (10 minutes): Comprehensive explanation of serverless computing with Azure Functions, including practical use cases and benefits.
        - Azure Cosmos DB (10 minutes): Detailed discussion on Azure Cosmos DB, its role in global data distribution, and a specific implementation scenario.
    - Industry-Specific Applications of Azure (40 minutes)
        - Government and Public Sector (10 minutes): Exploring Azure's applications in government services, focusing on security, compliance, and scalability.
        - Retail Industry (10 minutes): Use of Azure in retail, including aspects of customer experience enhancement, inventory management, and data analytics.
        - Healthcare Sector (10 minutes): Discussion on Azure in healthcare, covering patient data management, medical research, and telemedicine applications.
        - Manufacturing (10 minutes): Azure's role in manufacturing, including IoT integration, supply chain optimization, and predictive maintenance.

Week 6: GCP - Specialized Services

- Presentation 6: GCP’s AI and Machine Learning Services (GCP Team) - Present on Google Cloud's AI and machine learning offerings, such as TensorFlow and Google AI Platform, highlighting their capabilities and use cases in industry scenarios.
    - Introduction to GCP’s AI and Machine Learning Services (40 minutes)
        - TensorFlow (10 minutes): A comprehensive introduction to TensorFlow, its core features, and a detailed use case showcasing its application in machine learning projects.

        - Google AI Platform (10 minutes): In-depth overview of the AI Platform, explaining how it supports the development and deployment of AI models, with a real-world example.
        - AutoML (10 minutes): Detailed explanation of AutoML, its capabilities in automating the machine learning workflow, and a specific implementation scenario.
        - BigQuery ML (10 minutes): Discussion on BigQuery ML, focusing on its integration with BigQuery for data analysis and machine learning, accompanied by a case study.
    - Industry-Specific Applications of GCP AI and ML Services (40 minutes)
        - Healthcare and Life Sciences (10 minutes): Exploring how GCP's AI and ML services are revolutionizing healthcare, including drug discovery, patient care, and research.
        - Retail and E-commerce (10 minutes): Use of GCP's AI and ML in retail, focusing on customer behavior analysis, personalized recommendations, and inventory management.
        - Financial Services (10 minutes): Discussing the application of AI and ML in finance for fraud detection, risk management, and customer service automation.
        - Manufacturing and Industrial (10 minutes): Presentation on the use of GCP AI and ML in manufacturing for predictive maintenance, quality control, and supply chain optimization.

Week 7: AWS - Enterprise and Innovation

- Presentation 7: AWS for Enterprise Solutions (AWS Team) - Discuss AWS's solutions for enterprise-scale applications, focusing on aspects like scalability, security, and reliability in large organizations.
    - Introduction to AWS Enterprise Solutions (40 minutes)
        - Scalability with AWS (10 minutes): A detailed introduction to how AWS supports scalability for enterprises, including a discussion of services like Auto Scaling and Elastic Load Balancing, with a real-world example.
        - Security Features of AWS (10 minutes): In-depth overview of AWS's security offerings, such as AWS Identity and Access Management (IAM) and AWS Shield, highlighting how they ensure enterprise-level security.
        - Reliability and High Availability (10 minutes): Detailed explanation of AWS's infrastructure and services like Amazon S3 and AWS Lambda that provide high reliability and availability, accompanied by a case study.

        - AWS Management Tools (10 minutes): Discussion on various AWS management tools like AWS CloudFormation and AWS Config that assist in the efficient management of enterprise-scale applications.
    - Industry-Specific Applications of AWS Enterprise Solutions (40 minutes)
        - Financial Services (10 minutes): Exploring AWS's role in the financial sector, focusing on aspects like compliance, security, and data analytics.
        - Healthcare (10 minutes): Use of AWS in healthcare, covering patient data management, compliance with regulations (like HIPAA), and telehealth solutions.
        - Manufacturing (10 minutes): Discussion on the application of AWS in manufacturing for process optimization, supply chain management, and predictive maintenance.
        - Public Sector (10 minutes): Presentation on AWS's contributions to the public sector, focusing on government cloud solutions, security, and civic engagement platforms.

Week 8: Azure - Hybrid Cloud and AI

- Presentation 8: Azure Hybrid Cloud Solutions (Azure Team) - Cover Microsoft Azure's capabilities in hybrid cloud environments, including tools like Azure Stack and Azure Arc, and their importance for businesses seeking flexibility.
    - Introduction to Azure Hybrid Cloud Solutions (40 minutes)
        - Azure Hybrid Cloud Overview (10 minutes): A comprehensive introduction to the concept of hybrid cloud in the context of Azure, explaining its significance for businesses seeking flexibility and scalability.
        - Azure Stack (10 minutes): In-depth discussion on Azure Stack, its features, and how it extends Azure services and capabilities to on-premises environments, including a case study.
        - Azure Arc (10 minutes): Detailed exploration of Azure Arc, focusing on its role in managing applications across multiple environments, and a practical implementation example.
        - Security and Compliance in Azure Hybrid Solutions (10 minutes): Examination of security and compliance aspects specific to Azure's hybrid cloud offerings, emphasizing how they cater to enterprise needs.
    - Industry-Specific Applications of Azure Hybrid Cloud (40 minutes)
        - Government and Public Sector (10 minutes): How Azure Hybrid Cloud is used in government sectors, focusing on compliance, data sovereignty, and public service delivery.

        - Healthcare (10 minutes): Application of Azure Hybrid Cloud in healthcare, including patient data management, regulatory compliance, and research collaboration.
        - Financial Services (10 minutes): Discussion on Azure Hybrid Cloud in finance, covering aspects like data security, regulatory compliance, and disaster recovery.
        - Manufacturing (10 minutes): Presentation on the use of Azure Hybrid Cloud in manufacturing for data integration, IoT scenarios, and supply chain optimization.

Week 9: GCP - Security and Case Studies

- Presentation 9: Security in GCP (GCP Team) - Discuss the security features of GCP, including its infrastructure security, compliance, and data protection capabilities.
    - Introduction to GCP Security Features (40 minutes)
        - Overview of GCP Security (10 minutes): A comprehensive introduction to the importance of security in cloud computing and how GCP addresses these needs.
        - Infrastructure Security (10 minutes): Detailed discussion on GCP's infrastructure security, including physical and network security measures, and a real-world example of their implementation.
        - Compliance and Certifications (10 minutes): In-depth exploration of GCP’s compliance measures with various standards (like GDPR, HIPAA) and the importance of these certifications for businesses.
        - Data Protection and Privacy (10 minutes): Examination of GCP’s data protection mechanisms, such as encryption, identity and access management, and privacy controls.
    - Industry-Specific Applications of GCP Security (40 minutes)
        - Financial Services (10 minutes): Discussion on how GCP's security features are applied in the finance sector, focusing on aspects like data security, compliance, and fraud detection.
        - Healthcare (10 minutes): Application of GCP security in healthcare, covering patient data protection, regulatory compliance, and secure data sharing for research.
        - Retail (10 minutes): Exploration of GCP's role in securing retail operations, including data protection, PCI DSS compliance, and secure e-commerce platforms.
        - Public Sector (10 minutes): Presentation on the use of GCP security in government and public services, focusing on data sovereignty, secure communications, and compliance with public sector regulations.

Week 10: AWS - Cost Management and Case Studies

- Presentation 10: Cost Management in AWS (AWS Team) - Explore AWS's pricing model and cost optimization strategies, including tools and practices for effective budget management in AWS.
    - Introduction to AWS Cost Management (40 minutes)
        - Overview of AWS Pricing Model (10 minutes): A comprehensive introduction to the AWS pricing structure, including pay-as-you-go, save when you reserve, and pay less using more.
        - AWS Cost Management Tools (10 minutes): Detailed discussion on tools like AWS Cost Explorer, AWS Budgets, and AWS Pricing Calculator, and how they aid in effective budgeting and cost tracking.
        - Cost Optimization Best Practices (10 minutes): Exploration of strategies for cost optimization in AWS, such as right-sizing, reserved instances, and spot instances.
        - Understanding the AWS Billing and Cost Management Dashboard (10 minutes): A walkthrough of the AWS Billing Dashboard, focusing on how to monitor and manage expenses.
    - Case Studies and Real-World Applications (40 minutes)
        - Startup Cost Management (10 minutes): Case study of a startup efficiently managing costs on AWS, focusing on the utilization of cost-effective resources and budgeting tools.
        - Enterprise-Level Cost Optimization (10 minutes): Discussion of how large enterprises optimize costs in AWS, covering aspects like long-term contracts, bulk purchasing, and comprehensive cost audits.
        - E-commerce Cost Efficiency (10 minutes): Exploration of cost management in an e-commerce scenario, including seasonal traffic handling, scalable resources, and cost-effective storage solutions.
        - Public Sector Cost Management (10 minutes): Presentation on AWS cost management in the public sector, focusing on budget constraints, compliance with financial regulations, and cost-effective cloud strategies.

Week 11: Azure - Integration and Case Studies

- Presentation 11: Azure's Integration with Microsoft Ecosystem (Azure Team) - Discuss how Azure integrates seamlessly with other Microsoft products and services, enhancing productivity and collaboration.
    - Introduction to Azure's Integration with Microsoft Ecosystem (40 minutes)

        - Overview of Azure-Microsoft Integration (10 minutes): A comprehensive introduction to how Azure integrates with Microsoft products and services, enhancing cloud capabilities and user experience.
        - Integration with Office 365 (10 minutes): Detailed discussion on Azure's integration with Office 365, including shared identity with Azure Active Directory, and collaboration tools like SharePoint.
        - Azure and Microsoft Dynamics 365 (10 minutes): Exploration of the synergy between Azure and Dynamics 365, focusing on CRM, ERP solutions, and data analytics.
        - Azure and Microsoft Power Platform (10 minutes): A walkthrough of Azure's integration with the Power Platform, covering Power BI, PowerApps, and Power Automate, and their role in business process automation.
    - Case Studies and Real-World Applications (40 minutes)
        - Enterprise Productivity Case Study (10 minutes): Case study of an enterprise leveraging Azure's integration with Microsoft products for enhanced productivity and collaboration.
        - Healthcare Integration Scenario (10 minutes): Discussion of Azure's role in healthcare, focusing on integrating patient management systems with Dynamics 365 and data analysis with Power BI.
        - Retail Industry Application (10 minutes): Exploration of Azure's integration in retail, including customer data analysis with Office 365 and CRM management with Dynamics 365.
        - Public Sector Integration Example (10 minutes): Presentation on how Azure integrates with Microsoft's suite of products in public sector projects, enhancing service delivery and citizen engagement.

Week 12: Industry Trends

- Lecture 13: Future Trends in Cloud Computing
    - Discuss upcoming trends in cloud computing, such as edge computing, quantum computing in the cloud, and the evolving role of AI and machine learning.

Week 13-15: Final Presentations

- Presentation 13-15: Final Team Presentations - Each team presents a comprehensive summary of their platform, including key learnings, insights, and potential future develop
    - Overview of the Platform (15 minutes)
        - Recap of the platform's (GCP, AWS, or Azure) key features and services.
        - Brief discussion on the platform's current position and role in the cloud market.

- Deep Dive into Core Services (25 minutes)
  - Detailed exploration of the platform's core services, such as computing, storage, and databases.
  - Highlighting unique or standout services that distinguish the platform.
- Industry Applications and Case Studies (20 minutes)
  - Presentation of specific industry applications of the platform.
  - Summary of relevant case studies that demonstrate the platform’s capabilities and impact in real-world scenarios.
- Innovation and Future Developments (15 minutes)
  - Discussion on the platform's recent innovations and updates.
  - Insights or predictions about potential future trends and developments in cloud technology related to the platform.
- Concluding Remarks and Q&A Session (5 minutes)
  - Final thoughts and key takeaways about the platform.
  - Open the floor for questions and further discussion.