

## School of Computing and Information Sciences

**Course Title:** Cloud Essentials

**Date:** 12/24/2023

**Course Number:** CTS-3145

**Number of Credits:** 3

<b>Subject Area:</b> Systems	<b>Subject Area Coordinator:</b> Gregory Reis <b>email:</b> gmuradre@fiu.edu
<b>Catalog Description:</b> Covers the basics of Cloud computing from a business and technical perspective with focus on the acquisition of foundational certifications in cloud computing from the industry leaders.	
<b>Textbook:</b> None – Public information reading suggestions plus instructor created content	
<b>References:</b> “Exam Ref AZ-900 Microsoft Azure Fundamentals, 3rd Edition”, Jim Cheshire. Book ISBN -978-0-13-795514-5, eBook ISBN 978-0-13-831899-4. Microsoft Press. "AWS Certified Cloud Practitioner Study Guide With 500 Practice Test Questions: Foundational (CLF-C02) Exam Second Edition", Ben Piper, David Clinton. ISBN-10: 1394235631. ISBN-13: 978-1394235636. Sybex.	
<b>Prerequisites Courses:</b> COP-3804 or COP-3337 or equivalent	
<b>Corequisites Courses:</b> None	

Type: Elective for CS (Systems), IT (System Network), & CY Majors

Prerequisites Topics:

- Basic computing knowledge

Course Outcomes:

1. Differentiate Cloud fundamentals (e.g., SaaS/PaaS/IaaS, deployment models, common characteristics). [Understanding]
2. Recognize the benefits & disadvantages of Cloud services from a business perspective. [Remembering]
3. Describe the implications & strategies of security in the cloud. [Understanding]
4. Explain the various aspects of networking in the cloud. [Understanding]
5. Classify & categorize the storage and database options in Cloud computing. [Understanding]
6. Explain the various options for computing and automation in Cloud computing. [Understanding]
7. Compare & contrast the deployment solutions from the leading Cloud computing vendors, specifically AWS & AZURE. [Analyzing]
8. Demonstrate basic proficiency with cloud-based technologies, specifically AWS & AZURE. [Understanding]

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**Association between Student Outcomes and Course Outcomes**

<b>BS in Computing: Student Outcomes</b>	<b>Course Outcomes</b>
1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	1, 2, 3, 4, 5, 6
2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	1, 2, 7
3) Communicate effectively in a variety of professional contexts.	
4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	
5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	
<b>Program Specific Student Outcomes</b>	
6) Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]	
6) Apply security principles and practices to maintain operations in the presence of risks and threats. [CY]	3, 4
6) Use systemic approaches to select, develop, apply, integrate, and administer secure computing technologies to accomplish user goals. [IT]	1, 2, 3, 4, 5, 6

**Assessment Plan for the Course and how Data in the Course are used to assess Student Outcomes**

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan:  
<https://abet.cis.fiu.edu/>

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**Outline**

Topic	Lecture Hours	Outcome
<ul style="list-style-type: none"> <li>• Cloud Fundamentals               <ul style="list-style-type: none"> <li>• Foundational elements (virtualization, infrastructure as code)</li> <li>• Deployment models (public/private/hybrid)</li> <li>• Service models (SaaS, IaaS, PaaS)</li> <li>• Business justification for cloud usage</li> </ul> </li> </ul>	3	1,2
<ul style="list-style-type: none"> <li>• Security in the cloud               <ul style="list-style-type: none"> <li>• Shared responsibility model</li> <li>• Least privilege principle</li> <li>• Identity Management principles</li> <li>• AWS &amp; Azure specifics</li> </ul> </li> </ul>	6	3,7,8
<ul style="list-style-type: none"> <li>• Networking in the cloud               <ul style="list-style-type: none"> <li>• Networking basics (CIDR, DNS, Firewalls)</li> <li>• Regions &amp; Availability Zones</li> <li>• Virtual private cloud concepts</li> <li>• Integration with private clouds</li> <li>• AWS &amp; Azure specifics</li> </ul> </li> </ul>	8	3,4,7,8
<ul style="list-style-type: none"> <li>• Computing in the cloud               <ul style="list-style-type: none"> <li>• IaaS options in AWS &amp; AZURE</li> <li>• PaaS options in AWS &amp; AZURE</li> <li>• Containerization options in AWS &amp; Azure</li> <li>• Functions options in AWS &amp; AZURE</li> </ul> </li> </ul>	8	6,7,8
<ul style="list-style-type: none"> <li>• Storage &amp; Databases in the cloud               <ul style="list-style-type: none"> <li>• Local storage options in AWS &amp; AZURE</li> <li>• File sharing options in AWS &amp; AZURE</li> <li>• Object storage options in AWS &amp; AZURE</li> <li>• RDBMS options in AWS &amp; AZURE</li> <li>• NoSQL options in AWS &amp; AZURE</li> </ul> </li> </ul>	6	5,7,8
<ul style="list-style-type: none"> <li>• Auto-scaling, monitoring and automation               <ul style="list-style-type: none"> <li>• Auto-scaling options in AWS &amp; AZURE</li> <li>• Monitoring options in AWS &amp; AZURE</li> <li>• Infrastructure build automation in AWS &amp; AZURE</li> </ul> </li> </ul>	6	6,7,8
<ul style="list-style-type: none"> <li>• Cloud best practices               <ul style="list-style-type: none"> <li>• AWS Well-Architected Framework</li> <li>• Reliability &amp; High-Availability</li> <li>• Cost Optimization</li> </ul> </li> </ul>	3	2,7,8

**Learning Outcomes:** (Familiarity → Usage → Assessment)

Pervasive Themes in IT:

1. Explain how the components of an IT system interrelate. [Assessment]
2. Explain how and why complexity occurs in IT. [Familiarity]
3. Solve for complexity in an information technology environment by applying best

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practices and using appropriate technologies and methodologies. [Familiarity]

Security Mechanisms (Countermeasures):

1. Explain the three key factors involved in authentication and how they are used to verify identity and grant access to a system. [Assessment]
2. Explain the differences between symmetric and asymmetric cryptosystems, e.g., number of keys required, the types of algorithms used, etc. [Assessment]
3. Explain how public key infrastructure (PKI) works. [Familiarity]

Information Management Concepts and Fundamentals

1. Explain the role of data, information, and databases in organizations. [Familiarity]
2. Explain basic issues of data retention, including the need for retention, physical storage, security. [Familiarity]

Managing the Database Environment:

3. Explain the concept of database security. [Familiarity]
4. Describe n-tier database architecture. [Assessment]
5. Describe the concept of web services and the role of SOAP. [Assessment]

Computing Infrastructures:

1. Classify and describe the various types of servers and services required within organizations. [Assessment]

Foundations of Networking:

1. Compare and contrast the OSI and Internet models as they apply to contemporary communication protocols. [Assessment]
2. Analyze and compare the characteristics of various communication protocols and how they support application requirements. [Usage]
3. Describe and explain why different technologies are deployed in different contexts of networking, such as topology, bandwidth, distance, and number of users. [Assessment]

Operating Systems:

1. Describe the advantages and issues associated with virtualization. [Assessment]
2. Explain the value of fault tolerance for disaster recovery. [Assessment]
3. Identify situations in which a support organization needs to be consulted in resolving operating system issues. [Usage]

Administrative Domains:

1. Describe the responsibilities common to the various administrative domains. [Assessment]
2. Describe the responsibilities unique to each of the various administrative domains. [Assessment]
3. Identify responsibilities in each domain that support activities in other domains. [Familiarity]

Organizational Context:

1. Outline the basic parts of a typical IT environment. [Assessment]

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**Course Outcomes Emphasized in Laboratory Projects / Assignments**

	<b>Outcome</b>	<b>Number of Weeks</b>
1	Complete AWS & AZURE vendor-provided labs Outcomes: 3,4,5,6,7,8	10
2	Graded quizzes on each section	12
3	Multiple certification exam preparation practice tests near semester end – certification attainment part of grade	4

**Oral and Written Communication:** No significant coverage

**Social and Ethical Implications of Computing Topics:** No significant coverage

**Theoretical Contents**

1.	Network architecture and network design
2.	Authentication/authorization methods
3.	Server virtualization
4.	Cloud concepts (service models, deployment models, security, automation, business justification)
5.	Storage and database models

**Problem Analysis Experiences**

1.	Identify potential issues with cloud deployments
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**Solution Design Experiences**

1.	Build cloud infrastructure
2.	Deploy applications on cloud infrastructure

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**The Coverage of Essential & Supplementary IT Domains<sup>1</sup>**

<b>Knowledge Unit</b>	<b>Topic</b>	<b>Lecture Hours</b>
ITE-NET-02	Foundations of networking	3
ITS-VSS-04	Server Virtualization	2
ITS-VSS-05	Network Virtualization	3
ITS-CCO-01	Cloud computing perspectives & impact	6
ITS-CCO-02	Cloud computing concepts and fundamentals	8
ITS-CCO-03	Cloud computing Security and data considerations	8
ITS-CCO-04	Using cloud computing applications	2
ITS-CCO-05	Cloud computing architecture	3
ITS-CCO-07	Cloud computing infrastructure and data	5

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<sup>1</sup>See *Information Technology 2017 - Curriculum Guidelines for Baccalaureate Degree Programs in Information Technology*; by Association for Computing Machinery (ACM), IEEE Computer Society; cf. Essential & Supplementary IT Domains, pages 51 & 52. Available at: <https://www.acm.org/binaries/content/assets/education/curricula-recommendations/it2017.pdf>

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**Grading Weights**

- **Completion of AWS Cloud Foundations course (20%)** – This would only be a completion %, not grading the assignments. This is viewable through Canvas.
- **Completion of AZURE AZ-900 online course (20%)** – This is NOT viewable, so recommendation would be for instructor to ask students to submit brief summaries of each major section. This can be graded but the intention is just to track completion.
- **Quizzes on each major section (7 of them) (30%)** – These could be open book on Canvas and then reviewed in class to reinforce the lectures.
- **Certification Exams (30% - 100 points)** – These could be graded as follows:
  - o 20 points for registering and taking for the AWS and/or AZURE certification exam – 40 points maximum.
  - o 30 points for each certification achieved – 60 points maximum.
- No Final Exam

**Grading Scale**

Letter	Range%	Letter	Range%	Letter	Range%
A	95 or above	B	83 - 86	C	70 - 76
A-	90 - 94	B-	80 - 82	D	60 - 69
B+	87 - 89	C+	77 - 79	F	59 or less