COLUMBUS STATE
COMMUNITY COLLEGE

Northern Virginia (NOVA) Cloud Curriculum

NSF ATE Reach for the Cloud: Building an Industry-Aligned Pathway to Careers in Cloud Computing

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CLOUD COMPUTING

This curriculum is designed for those who seek employment in the field of cloud computing, for those who are presently in that field and who desire to increase their knowledge and update their skills, and for those who must augment their abilities in other fields with knowledge and skills in cloud computing.

IN **THIS SECTION**

Cloud Computing at NOVA

Program Details

NOVA is leading the nation in Cloud Computing education and is nationally recognized for being the first community college to develop and offer an Associate degree in Cloud Computing. Our programs were aligned to industry

Cloud Computing Flyer

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needs through close interaction with leading cloud providers and serves as a model for the development of cloud-focused curriculum across the globe.

Our programs will prepare you for an entry-level position or augment your existing skills using industry leading platforms like Amazon Web Services (AWS), while immersing you in course work that sets you up for multiple industry certifications. Want options? How about our stackable one year Career Study Certificate (C.S.C.) or jump right into the full Associate of Applied Science (A.A.S.) degree. Either way results will come quickly with full-time enrollment. Ultimately want a bachelor's degree? We can do that. We have transfer agreements with top four-year institutions to make that your reality.

Students should possess a proficiency in high school English, familiarity with computer functions and hardware, and possess computer keyboarding skills. It is recommended that students be placed into MTH 154 or higher although this program includes no math courses.

Transfer Opportunities

Transfer is not the primary purpose of C.S.C and A.A.S. programs, but NOVA has articulation agreements that facilitate the transfer of this and other career-oriented programs to selected senior institutions. Students interested in transfer should contact a counselor or their academic advisor early in their program.

Credit for Prior Learning

Northern Virginia Community College accepts industry-standard certifications, credentials and/or professional courses for credit. Broadly, licenses, credentials and/or certifications must be current and valid for consideration. For more information regarding the status of the certification and its eligibility for credit, please see an advisor or faculty members in the discipline area that awards CPL credit.

The most current information can be found <u>here</u> for CPL: Certifications and Credentials.

CPL examples: AWS – AWS Certified Cloud Practitioner, AWS – AWS Solutions Architect Associate, CompTIA - A+ Hardware, CompTIA - Linux +, CompTIA - Network+ CompTIA - Security+, ISC2 – CISSP, CIW – CIW Associate, CIW – CIS Associate Design Specialist

Program Degrees and Certificates

WANT TO LEARN MORE?

REQUEST INFO

A Cloud Computing CSC can be achieved within the AAS degree - must be applied for. Specific program courses provide the knowledge and skills to test for industry certifications. The IET Division strongly recommends that students take a preparatory or review course prior to setting for an exam. Exam fees are not included in the course fees or tuition. Possible industry certifications: AWS – AWS Certified Cloud Practitioner, AWS – AWS Solutions Architect Associate, CompTIA - A+ Hardware, CompTIA - Linux +, CompTIA - Network+ CompTIA - Security+

NOTE: Previous IT courses used for these programs may not be more than 10 years old, unless approved by academic dean.

Cloud Computing Specialization, A.A.S.   –

CIP Code: 11.0103

NOVA Code: 2995

Purpose: This curriculum is designed for those who seek employment in the field of cloud computing, for those who are presently in that field and who desire to increase their knowledge and update their skills, and for those who must augment their abilities in other fields with knowledge and skills in cloud computing.

Credit for Prior Learning: Students in this program may be eligible for credit for prior learning. See an academic advisor or counselor for further information.

Transfer Information: Transfer is not the primary purpose of an A.A.S. program, but NOVA has articulation agreements that facilitate the transfer of this and other career-oriented programs to selected senior institutions. Students interested in transfer should contact a counselor or their academic advisor early in their program.

Recommended Preparation: The student should possess a proficiency in high school English, high school algebra and geometry, and computer keyboarding skills.

Two Years

1st Semester

- ENG 111 - College Composition I (3 CR.)
- ITE 152 - Introduction to Digital and Information Literacy and Computer Applications (3 CR.)

- ITN 101 - Introduction to Network Concepts (3 CR.)
- ITN 257 - Cloud Computing: Infrastructure and Services (3 CR.)
- MTH 154 - Quantitative Reasoning (3 CR.) **OR** Higher
- SDV 101 - Orientation to (a Specific Discipline) (1 CR.)

Total 16 credits

2nd Semester

- ITD 256 - Advanced Database Management (3 CR.)
- ITN 107 - Personal Computer Hardware and Troubleshooting (3 CR.)
- ITN 200 - Administration of Network Resources (3 CR.)
- ITN 260 - Network Security Basics (3 CR.)
- ITP 100 - Software Design (3 CR.)

Total 15 credits

3rd Semester

- —— - IT Elective (3 CR.)
- ITD 110 - Web Page Design I (3 CR.)
- ITN 170 - Linux System Administration (3 CR.)
- ITN 213 - Information Storage and Management (3 CR.)
- ITP — - Elective (3 CR.)

Total 16 credits

4th Semester

- CST — - Elective (3 CR.)
- ITN 254 - Virtual Infrastructure: Installation and Configuration (4 CR.)
- —— - Humanities/Fine Arts Elective (3 CR.)
- —— - Social/Behavioral Sciences Electives (6 CR.)

Total 16 credits

Total credits for the A.A.S. Degree in Information Systems Technology; Cloud Computing Specialization: 63 credits

Cloud Computing, C.S.C.   +

Career Prospects

There is immediate and significant demand for employees with cloud computing capability. Combining our programs with the potential to earn multiple industry certifications can make you highly qualified and in-demand. Entry-level salaries for these positions are competitive and commensurate with your qualifications. Graduates from this program can find employment opportunities in areas like cloud computing specialist and cloud support associate.

What could my career look

Local Region

Career

Select career area

Select career

There have been

3,422

job postings in the last year

There are

17

different career

Career Demand

85%

Get Started

Would you like to get started with this program? Speak with an adviser to start shaping your educational journey at NOVA. Click a button below to locate an advisor and register for an advising session.

LEARN MORE   CONTACT AN ADVISOR

ADVANCE

For the 2022-2023 catalog year, there are many pathways to choose from! In order to make it easier to find the degree that interests you, they have been sorted into categories. Use the search tool to find the program pathway for your degree of interest.

ADVANCE Program Milestones:

ADVANCE Milestone Requirements: All ADVANCE students must adhere to the following requirements. For Milestones #1-#3, failure to meet these milestones will prevent a student from matriculating to Mason and/or result in termination from ADVANCE. For Milestones #4-#7, failure to meet these milestones may delay matriculation to Mason.

1. Students must complete their NOVA degree within 4 years of being admitted into ADVANCE. Students are highly encouraged to be continuously enrolled at NOVA/Mason to support progress towards degree completion.
2. Students must maintain a minimum 2.5 cumulative GPA at NOVA and must have a minimum 2.5 GPA upon matriculation to Mason.
3. Students who wish to enroll at Mason for the fall semester must apply for NOVA spring graduation by March 1 or summer graduation by June 1. Students who wish to enroll at Mason for the spring semester must apply for NOVA fall graduation by October 1.
4. Students must begin developmental coursework no later than the first semester in ADVANCE at NOVA.
5. Students must take first college-level MTH course and ENG 111 in the semester immediately following the completion of any MDE or EDE courses (excluding summer).
6. In the first 30 credits, students must complete ENG 111 and ENG 112 with a C or better.
7. Students must complete a Mason Core Quantitative Reasoning course equivalent with a C or better no later than one semester before NOVA graduation. Refer to your pathway to select the appropriate MTH course(s).

Program-Specific Requirements: BAS programs have specialized admission criteria. In this pathway, the Mason Core Quantitative Reasoning course is completed at Mason. Refer to the courses below to select the appropriate math course at NOVA.

If English is not your first language or you have completed ESL coursework, you must complete ENG 111 and ENG 112 prior to matriculating to Mason to meet the English Language Proficiency requirement. Please reach out to ADVANCE Admissions early if you have any questions about this requirement: advance@gmu.edu.

BAS degrees are designed for adult learners who have some work experience in their field of choice, but the degree is open to students of all ages. Further, BAS degrees are often considered terminal degrees (i.e., they may not lead to advanced study in master's degree or doctoral programs). Students who are interested in advanced study are encouraged to contact graduate programs early to determine if the BAS program fits their requirements.

A.A.S. Information Systems Technology Cloud Computing Specialization

NORTHERN VIRGINIA COMMUNITY COLLEGE			MASON	
NOVA Degree Requirement	**NOVA Course**	**Credits**	**Transfer to MASON As**	**MASON Degree Requirement**
SDV Course	SDV 101 Orientation to Information Technology	1	UNIV 100	General Elective
ENG 111	ENG 111 College Composition I	3	ENGH 101	Written Comm
ITE 152	ITE 152 Introduction to Digital and Information Literacy and Computer Applications	3	IT 104	Info Tech

ITN 101	ITN 101 Introduction to Network Concepts	3	IT XXX	Major
ITN 257	ITN 257 Cloud Computing: Infrastructure and Services	3	BAS ---	Major
MTH 161 Required (NOVA Catalog: MTH 154 or Higher)	MTH 161 Pre-Calculus I	3	None	Prerequisite
ITD 256	ITD 256 Advanced Database Management	3	IT ---	Major
ITN 107	ITN 107 Personal Computer Hardware and Troubleshooting	3	IT XXX	Major
ITN 200	ITN 200 Administration of Network Resources	3	BAS ---	Major
ITN 260	ITN 260 Network Security Basics	3	IT ---	Major
ITP 100	ITP 100 Software Design	3	IT ---	Major
IT Elective	ITN 106 Microcomputer Operating Systems *or*	3	BAS ---	Major
	ITN 290 Coordinated Internship *or*		BAS ---	
	ITN 295 Topics in ---		BAS ---	
ITD 110	ITD 110 Web Page Design I	3	IT ---	Major
ITN 170	ITN 170 Linux System Administration	3	BAS ---	Major
ITN 213	ITN 213 Information Storage and Management	3	BAS ---	Major
ITP Programming Elective	ITP 120 Java Programming I *or*	4	IT 106	Major
	ITP 150 Python Programming		IT 109	
CST Elective	CST 100 Principles of Public Speaking *or*	3	COMM 100	Oral Comm
	CST 110 Introduction to Human Communication		COMM 101	
ITN 254	ITN 254 Virtual Infrastructure: Installation & Configuration	4	BAS ---	Major
Humanities/Fine Arts	ART 100 Art Appreciation *or*	3	ARTH 101	Arts
	ART 101 History of Art: Prehistoric to Gothic *or*		ARTH 200	
	ART 102 History of Art: Renaissance to Modern *or*		ARTH 201	
	CST 130 Introduction to Theatre *or*		THR 101	
	CST 151 Film Appreciation I *or*		ENGH L372	
	MUS 121 Music in Society		MUSI 101	
Social/Behavioral Sciences #1	ECO 201 Principles of Macroeconomics *or*	3	ECON 104	Soc/Behav

	ECO 202 Principles of Microeconomics *or*		ECON 103	
	GEO 210 People and the Land: An Introduction to Cultural Geography *or*		GGS 103	
	HIS 121 United States History to 1877 *or*		HIST 121	
	HIS 122 United States History Since 1865 *or*		HIST 122	
	PLS 135 U.S. Government and Politics *or*		GOVT 103	
	PSY 200 Principles of Psychology *or*		PSYC 100	
	PSY 230 Developmental Psychology *or*		PSYC 211	
	SOC 200 Introduction to Sociology *or*		SOCI 101	
	SOC 211 Cultural Anthropology		ANTH 114	
Social/Behavioral Sciences #2	HIS 101 Western Civilizations Pre-1600 CE *or*	3	HIST 101	Western Civ
	HIS 102 Western Civilizations Post-1600 CE *or*		HIST 102	
	HIS 112 World Civilizations Post-1500 CE		HIST 125	
		Total Credits: 63		
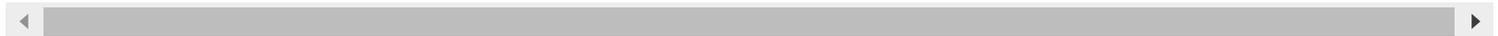
For academic policies and procedures, please see NOVA catalog - http://www.nvcc.edu/catalog/index.html

B.A.S. Concentration in Cloud Computing (Info Systems Tech)

This pathway only applies to the Cloud Technology track within the Cloud Computing Concentration.

MASON Degree Requirement Sequence	Course	Credits	MASON Core/Degree Equivalent
Concentration Requirements	MATH 108 Introductory Calculus with Business Applications	3	Quantitative
Concentration Requirements	IT 102 Discrete Structures	3	Major
Concentration Requirements	IT 105 IT Architecture Fundamentals	3	Major
Core Program Requirements	BAS 300 Building Professional Competencies	3	Major
Mason Core: Literature	Any approved Literature course(1) (Upper-level)	3	Literature
General Electives	Any General Elective course (Upper-level)	3	General Elective

Concentration Requirements	IT 300 Modern Telecommunications	3	Major
Mason Core: Written Communication (Upper-Level)	ENGH 302 Advanced Composition	3	Written Comm
Mason Core: Natural Science without Lab	Any approved Natural Science without Lab course(1) (Upper-level: See Advisor)	3	Nat Science
Mason Core: Global Understanding	Any approved Global Understanding course(1) (Upper-level)	3	Global
Concentration Requirements	IT 341 Data Communication and Network Principles	3	Major
Concentration Requirements	IT 343 IT Project Management	3	Major & Writing Intensive
Concentration Requirements	IT 451 Cloud Services Management	3	Major
Concentration Requirements	IT 461 Application Development in Cloud	3	Major
Core Program Requirements	BAS 490 Introduction to Research Methods (2) *or*	3	Major
	BAS 492 Capstone Development(2)		
Concentration Requirements	IT 442 Cloud Infrastructure	3	Major
Concentration Requirements	IT 481 Cloud Security	3	Major
Mason Core: Natural Science with Lab	Any approved Natural Science with Lab course(1)	4	Nat Science
Core Program Requirements	BAS 491 Applied Sciences Capstone(2) *or*	3	Synthesis
	BAS 493 BAS Capstone(2)		
		Total Credits: 121	

*Denotes a course that must be taken at George Mason University while attending NOVA. Failure to complete your co-enrollment course(s) while attending NOVA can significantly affect your timeline for Mason graduation. Please see your ADVANCE Coach for more information and to enroll.

Important Academic Information:

(1)For approved Mason Core courses, please visit - https://catalog.gmu.edu/mason-core/

(2)Students must select either BAS 490 and BAS 491 or BAS 492 and BAS 493.

Additional General Notes & Resources:

• To graduate in the BAS with a Cloud Computing concentration, students must have a C or better in their major core and concentration courses.

• If English is not your first language or you have completed ESL coursework, you must complete ENG 111 and ENG 112 prior to matriculating to George Mason University to meet the English Language Proficiency requirement.

• For academic policies and procedures, please see Mason catalog - https://catalog.gmu.edu/policies/

• Students seeking a bachelor's degree must apply at least 45 credits of upper-level courses (numbered 300 or above) toward graduation.

ITN 254 - Virtual Infrastructure: Installation and Configuration (3 CR.)

Course Description

Prerequisites: ITN 257 and ITN2 13. ITN254 focuses on the installation and the configuration of cloud computing infrastructure. Including the development, deployment and the design of virtual computing environment. The course discusses various virtualization technologies and application currently implemented in the industry. Such as Virtual Box, VM Ware, and Open Stack software.

General Course Purpose

Virtual Infrastructure: Installation and Configuration is a critical part of designing reliable and secure cloud computing infrastructure system. Business enterprises and government entities are moving aggressively from the traditional on-premise data center to the cloud. Such moves require trained cloud computing design architecture and engineers.

In this course students will learn the fundamentals of high availability cloud computing system that supports business continuity. Learn the design-cost aware systems. Learn cost optimized cloud computing systems and optimized for use by different types of organization both public and private sectors

Course Prerequisites:

ITN 257 and ITN213

Course Objectives

Upon completion of this course, students will be able to:

a) Describe high availability and business continuity cloud computing design.

b) Demonstrate the ability to design an architectural cloud computing environment with optimized cost.

c) Articulate the skills and the ability to manage cloud-based application systems.

d) Demonstrate the ability of sound network design principles in small, medium and large-scale complex enterprise networks.

e) Define and design secure cloud computing environment. Design security controls with shared responsibility models between the cloud providers and the cloud consumers.

f) Design data access controls. Data protection at different states: data in transit and data at rest.

g) Demonstrate the ability of designing scalable and elastic computing environment.

Major Topics to be Included

1. Resilient cloud design and architecture principles.
2. Cost effective and optimized cloud computing design
3. Software and application development lifecycle
4. Secure cloud environment with authentication, authorization, and accounting principles (AAA).
5. Secure data with access control principles both for data in transit and data at rest.

6. Secure data storage.
7. Design scalable, reliable and elastic cloud computing environment.

Required Time Allocation per Topic

In order to standardize the core topics of this course so that a course taught at one campus is equivalent to the same course taught at another campus, the following student contact hours per topic are required. Each syllabus should be created to adhere as closely as possible to these allocations. The course can be given in the standard 16-week, 12-week, or 8-week section format. All format offering should meet the same number of contact hours. The final exam time is not included in the timetable.

Topics	Hours	Percent
Building virtual servers. Windows Servers and Linux servers	9	20%
Highly available system for business continuity support.	9	20%
Designing Cost optimized cloud computing environment.	3	7%
Application deployment and lifecycle application development.	9	20%
Best practice in cloud computing network design, and secure data and system access (AAA)	9	20%
Exams, quizzes, and assignments to demonstrate knowledge	6	13%
Total	45	100

NOVA COLLEGE-WIDE COURSE CONTENT SUMMARY
ITN 257 - CLOUD COMPUTING: INFRASTRUCTURE AND SERVICES (3 CR.)

Course Description

Focuses on cloud infrastructure, deployment, security models, and the key considerations in migrating to cloud computing. Covers the technologies and processes required to build traditional, virtualized, and cloud data center environments, including computation, storage, networking, desktop and application virtualization, business continuity, security, and management. Lecture 3 hours per week.

General Course Purpose

Cloud computing is becoming increasingly popular in the field of information technology. Companies in the industry are relying on various cloud computing services for storage, processing power, and an alternative to on-premises solutions. Students will gain an introduction to the cloud-computing environment and various services offered. The course is intended for people interested in the IT legal and IT marketing fields, business analysts, project managers, and other IT-related processionals.

Course Prerequisites/Corequisites:

None

Course Objectives

Upon completion of this course, students will be able to:

a) Define cloud services and the basic global cloud infrastructure
b) Describe the key services on the cloud platform and their common features
c) Describe basic cloud architectural structures
d) Describe basic security and compliance aspects of the cloud platform and the shared security model
e) Define vendor support, account management and pricing models

Major Topics to be Included

1. Define basics, cloud services and the basic global cloud infrastructure
    1.1. Computing models
        1.1.1. Traditional on-premises computing
        1.1.2. Cloud computing
        1.1.3. Hybrid – connecting on-premises with cloud computing
    1.2. Cloud Architecture and Data Centers
        1.2.1. Physical Security
        1.2.2. Redundant power, networking, and connectivity in separate facilities
        1.2.3. Fault tolerance to remain operational during component failure
    1.3. Cloud Concepts
        1.3.1. Scalability, Elasticity
        1.3.2. Auto Scaling
        1.3.3. Load Balancing
        1.3.4. Reliability, Fault Tolerance
        1.3.5. Automation
        1.3.6. Decoupling
    1.4. Cloud Benefits
        1.4.1. Resource Management
        1.4.2. Agility, Experimentation, Innovation

       1.4.3. Reliability
       1.4.4. Costs
   1.5.   Describe basic/core characteristics of deploying and operating in the AWS Cloud

2.   Describe the key services on the cloud platform and their common features.
   2.1.   IaaS
   2.2.   PaaS
   2.3.   Examples of Hardware, Operating Systems, and Software Images
   2.4.   Elastic Computing, Scalability and Auto Scaling
   2.5.   Load Balancing
   2.6.   Disaster Recovery
   2.7.   Storage
       2.7.1. Elastic Storage
       2.7.2. SSD vs. Magnetic Storage
       2.7.3. Cold Storage
       2.7.4. Availability and Durability
       2.7.5. Replication
       2.7.6. Caching Services
       2.7.7. Data Transfer from on-prem to cloud
   2.8.   Databases
       2.8.1. Relational Databases
       2.8.2. Data Warehousing
       2.8.3. Database Migration Services
       2.8.4. Data Transfer from on-prem to cloud
       2.8.5. Other database options, if applicable
   2.9.   Monitoring
       2.9.1. System Monitoring
       2.9.2. Performance Monitoring
       2.9.3. Cost Monitoring
       2.9.4. Optimization
       2.9.5. Notifications
       2.9.6. Threshold Limits
       2.9.7. Automation
   2.10. Event-driven computing, events and listeners
   2.11. Tagging / Labeling of Products for ease of management
   2.12. "Serverless" Architecture
   2.13. Debugging
   2.14. Queueing
   2.15. Content Delivery and/or Web Front-End Features
   2.16. Optional – Additional Features, as applicable
   2.17. Software Development Kits and APIs
   2.18. Deployment
       2.18.1.   Process(es) for Deployment
       2.18.2.   Use of templates or other mechanism for controlled, repeatable deployment
   2.19. Optional - Any additional important features or services, if applicable

3.   Describe basic cloud architectural structures.
   3.1.   High Availability
   3.2.   Fault Tolerance
   3.3.   Services and Features

4.   Describe basic security and compliance aspects of the cloud platform and the shared security model
   4.0   Customer Responsibilities vs. Vendor Responsibilities
   4.1.   Access Control & Management
       4.1.1. Security Groups, Roles, and/or Accounts
       4.1.2. Principle of Least Privilege
   4.2.   Malware, Vulnerability Scanning and Protection

4.3. Security Compliance Industry Standards

5. Define vendor support, account management and pricing models
    5.1. Pricing Plans
    5.2. Vendor Support Models
    5.3. Cost Exploration Tools
    5.4. Identify sources of documentation or technical assistance (e.g., whitepapers, support tickets)

Required Time Allocation per Topic

In order to standardize the core topics of this course so that a course taught at one campus is equivalent to the same course taught at another campus, the following student contact hours per topic are required. Each syllabus should be created to adhere as closely as possible to these allocations. Sections of the course that are given in alternative formats from the standard 16-week section still meet for the same number of contact hours. **The final exam time is not included in the time table.**

Topic	Hours	Percent
Cloud Basics and the global cloud infrastructure	3	6.5%
Cloud Services and Common Features	27	61%
Cloud Architecture Structures	3	6.5%
Security in the Cloud	3	6.5%
Vendor Support, Account Management and Pricing Model Examples	3	6.5%
Quizzes and/or Exams, to demonstrate knowledge	6	13%
Total:	45	100%

NOVA COLLEGE-WIDE COURSE CONTENT SUMMARY

ITN 213 - Information Storage and Management (3 CR.)

<u>**Course Description**</u>

Prerequisites: ITN 257. Focuses on storage systems, protocols, and architectures. Including the development of storage design and solution, cloud computing storage system, networking, application and data storage, cloud backup systems, database systems. The course discusses physical and logical storage. Physical storage discusses operating system file systems, hard disk partitions, and Redundant Array of Independent Disks (RAID) systems. Logical storage addresses network storage, databases and DBMS, backup technologies, and data warehouse. The course discusses and uses current trending storage technologies used by different vendors such Amazon and Microsoft. Lecture 3 hours per week.

<u>**General Course Purpose**</u>

Cloud storage is one of the cloud computing pillars. Business enterprises and government entities are moving on-primes data centers to the cloud. Cloud computing and cloud storage are becoming part of the global information technology infrastructure. Most companies are using the cloud systems and the cloud storage either as the main IT system or at minimum the backup system for failover and redundancy.

In this course students will learn the fundamental of various computer file systems, basic and dynamic disk systems, various technologies of RAID systems for redundancy the performance implementation. Students will learn different type of backup systems and backup types such as full backup, incremental and differential backup systems. Students will learn different database types such as relational and non-relational database. Database management systems DBMS. Cloud database concepts and technologies., Students will study and practice some of primary   database vendor and their footprint in databases design and implementation.

<u>**Course Prerequisites:**</u>

ITN 257 and ITD256

<u>**Course Objectives**</u>

Upon completion of this course, students will be able to:

a) Describe computer file system such as FAT, FAT32, DFS, NTFS, etc

b) Describe different type of storage media.

c) Define different type of disk systems, volume, partition, RAIDS.

d) Define different types of backup systems and database management systems.

e) Define different type of DBMS technologies used in the cloud by different vendors such Amazon, Microsoft and Google.

<u>**Major Topics to be Included**</u>

Data storage, availability, and redundancy (SAR).

1. Cloud design and architecture principles.
2. Cloud storage scalability, load balancing, elasticity, and redundancy.
3. Cloud service types: IaaS, SaaS, PaaS, DaaS
4. Storage type:
    a. Physical storage
    b. Database logical storage
    c. Network storage
    d. Cloud storage
5. Database type:
    a. Relational database
    b. Non-relational database
6. Vendors Cloud database implementation
    a. AWS case study
        i. Amazon Simple Storage Service (Amazon S3)
        ii. Amazon Glacier Storage
        iii. Amazon Elastic Compute Cloud (Amazon EC2)
        iv. Amazon Virtual Private Cloud (Amazon VPC)
        v. Amazon Elastic Block Store (Amazon EBS)
    b. Microsoft Azure case study
        i. Resource group
        ii. Web front end
        iii. Microsoft Databases and processes.
        iv. Microsoft Cognitive Services
7. Cloud Solution Architecture best practices
8. Storage design and implementation best practices
9. Discuss trending implementation of cloud computing in both public (government state and federal) and private sector (business enterprise).

Required Time Allocation per Topic

In order to standardize the core topics of this course so that a course taught at one campus is equivalent to the same course taught at another campus, the following student contact hours per topic are required. Each syllabus should be created to adhere as closely as possible to these allocations. The course can be given in the standard 16-week, 12-week, or 8-week section format. All format offering should meet the same number of contact hours. The final exam time is not included in the timetable.

Topics	Hours	Percent
Overview of operating systems, files systems, disk and media types	3	7%
Storage and backup systems	9	20%
Databases types and DBMS	9	20%
Cloud design and architecture principles and best practices	9	20%
Best practice in cloud computing, storage, database, and current trending vendors technology implementation	9	20%
Exams, quizzes, and assignments to demonstrate knowledge	6	13%
Total	45	100