Northeastern
College of Engineering

CSYE 6225: Network Structure & Cloud Computing [SPRING 2025]

Course Information
Course Title: Network Structure & Cloud Computing Course Number
Course Number: CSYE 6225
Term and Year: Spring 2025
Credit Hour: 4
Course Format: Traditional

Oakland, CA	Silicon Valley, CA
CRN: 40279 **Location:** Lucie Stern 010 **Time:** R 3:00 pm - 6:20 pm PT	**CRN:** 32945 **Location:** Room 916 **Time:** S 9:30 am - 12:50 pm PT

Instructor Information
Full Name: Raja Alomari, PhD
Email: r.alomari@northeastern.edu (**Please use messaging functionality in Canvas**).
Office Hours: Wed 4-5 PM (Link: Meeting Link - MS Teams) (Jan 6, 2024 - April 26, 2024).
Appointment: (Link: Book time with Dr. Alomari) (Jan 6, 2024 - April 26, 2024).
Contact: Please use messaging functionality in Canvas.

Teaching Assistant Information

Oakland, CA	Silicon Valley, CA
TA: Pritesh R. Nimje **Location:** MS Teams **TA Office Hours:** TBD **Meeting Link:** TBD **Meeting ID:** TBD **Passcode:** TBD	**TA:** Cheng-Wei Huang **Location:** MS Teams/In person. **TA Office Hours:** TBD **Meeting Link:** TBD **Meeting ID:** TBD **Passcode:** TBD

Course Prerequisites
CSYE 6200 with a minimum grade of B- or INFO 5100 with a minimum grade of B-

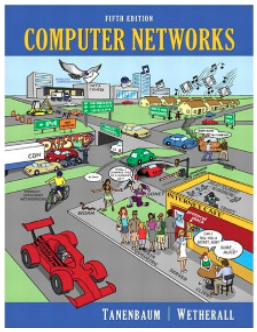
Course Description
Offers a practical foundation in cloud computing and hands-on experience with the tools used in cloud computing. Designed as a foundation course for cloud-aware, adept professionals. Focuses on the fundamentals of cloud computing, the principal areas of cloud architectures, cloud security, cloud governance, cloud storage, cloud virtualization, and cloud capacity. Discusses the Internet evolution that led to cloud and how cloud applications revolutionized Web applications.

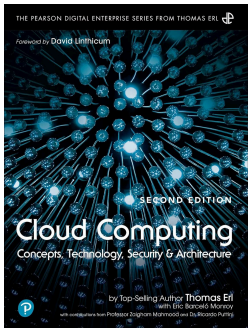
Course Learning Outcomes

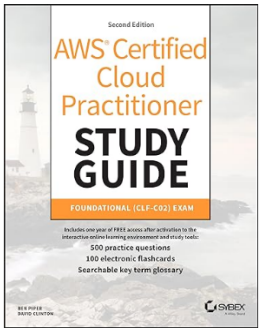
- Computer Networks: Students will obtain a high level understanding of network protocols and topologies in addition to various networking concepts.
- Cloud Computing and IAM: Students will compare cloud deployment models (Public, Private, Hybrid) and service models (IaaS, PaaS, SaaS), and create IAM policies, roles, and keys with appropriate access controls.
- Virtualization and Cloud Compute: Students will distinguish between hypervisor types, virtualization technologies, VMs, and containers, and deploy and manage virtual machines using AWS EC2 and Azure VM.
- Infrastructure as Code (IaC): Students will write and apply IaC scripts using Terraform or AWS CloudFormation, and deploy resources using YAML or JSON, as demonstrated in a case study.
- Cloud Storage and Databases: Students will configure and utilize AWS cloud storage solutions (S3, Glacier, EFS, FSx, EBS) and database services (RDS, DynamoDB) in practical scenarios.
- Cloud Monitoring and Managed Services: Students will set up and interpret cloud monitoring tools (CloudWatch, GCP Monitoring, Wavefront) and manage AWS services (Route53, CloudFront, Lambda, Aurora, Redshift) effectively.
- Cloud Security: Students will explore cloud security measures, including encryption at rest, key management, and apply security solutions (CWPPs, CASB, CSPM, SASE, ZTNA) in real-world scenarios.
- Cloud Architecture and Streaming: Students will design cloud architectures based on AWS Well-Architected Framework, implement VPCs, and disaster recovery solutions, and set up real-time data streaming pipelines with Kinesis or Kafka.
- Industry Use Cases: Students will analyze and present use cases for CloudHealth, CrowdStrike, CASBI, and Netflix, demonstrating their understanding of billing, threat detection, user analytics, and streaming.

Required Tools and Course Textbooks. The nature of this course requires multiple textbooks. The following list includes recommended reading resources, which are not mandatory.

- Computer Networks by Andrew S. Tanenbaum and David J. Wetherall
- Cloud Computing: Concepts, Technology, Security, and Architecture (The Pearson Digital Enterprise Series from Thomas Erl) 2nd Edition
- AWS Certified Cloud Practitioner Study Guide With 500 Practice Test Questions: Foundational (CLF-C02) Exam (Sybex Study Guide)







Tools: The following access and tools will be required to perform your assignments:

- Access to a Linux system (using University credentials).
- Access to AWS, Azure, or GCP. Signup for free access if you do not have one.
- Github account. Create an account if you do not have one.
- Access to a Private Cloud Environment such as Proxmox® or Pextra CloudEnvironment®.
- AWS Academy Account will be provided to each student.

Course Schedule/Topics Covered.

The following is the tentative schedule for this course. Please note that the provided date in each row is for the start of the week and not the actual class meeting date.

Order	Week	Module	Topics	HW & Quizzes
1 + 2	Jan 6 Jan 13	M1	• Course overview • Version Control and GitHub • Linux Commands and File System	Hands-on: Practice Linux commands. Coding assignment on GitHub Classroom. Requires github account. Submission: Github Classroom. Assignment M1-1 out Quiz M1-1
3	Jan 20	M2	Introduction to computer networking: Protocols: • IPv4/IPv6, MAC, TCP & TCP/IP, DNS, OSI, DHCP Concepts:	Hands-on: Networking command on Linux. Requires access to Linux (Will be guided to create AWS EC2

			● Types, Topologies, TCP/IP versus OSI, Metrics, Traffic and Monitoring, Security, Authentication versus Authorization, VPN, Firewall, IoT	instances for this purpose). Requires AWS access (free) Submission: Screenshots + PDF. Assignment M1-1 due Assignment M2-1 out Quiz M2-1
4 + 5	Jan 27 Feb 3	M3	Intro and overview of Cloud Computing ● Deployment Model: Public vs Private vs Hybrid Cloud. ● Service Model: IaaS, PaaS, SaaS. Managed vs unmanaged. ● Major public cloud providers. ● IAM: users, roles, policies, action, resource, Access Key, ssh key, trust relationship. ● AWS CloudFormation	Hands-on: AWS Access control (IAM), Compute (EC2), S3, CloudFormation (IaC), AWS CLI (IAM, EC2, S3, CloudFormation), Region and AZ, Billing. Requires AWS access (free) Submission: Screenshots + pdf. Assignment M2-1 due Assignment M3-1 out. Assignment M3-1 due. Assignment M3-2 out. Quiz M3-1 Quiz M3-2
6+7	Feb 10 Feb 17	M4	Private Cloud overview: ● Virtualization Concepts for compute, store, and networking resources. ● Hypervisor Type-1, Type-2, (Desktop, NW, Store, App) virtualization, VM vs Containers. ● Private Cloud Platforms: Proxmox (Open source), VM vCenter/vSphere, Nutanix.	Hands-on: Private Cloud overview, various virtualization technologies, containers vs VMs, (LXC, Docker®, Docker Desktop, K8), Proxmox®, Pextra CloudEnvironment®. Requires AWS access

			● Public Cloud Virtual Compute AWS EC2/AzureVM. Autoscaling. ● EC2, EBS, ELB, ASG, security group, Security settings and customization. ● Horizontal vs vertical scale. ● Hands on available private cloud management: Proxmox VM, Pextra CloudEnvironment™	(AWS Academy will be provided). Submission: Screenshots + pdf. Assignment M3-2 due Assignment M4-1 out Quiz M4-1 Quiz M4-2
8	**Feb 24**		**Midterm Exam (25%)**	**Optional project proposals (due before final). Extra Credit.**
9	**Mar 3**		**Spring Break**	
10	Mar 10	M5	Overview IaC. ● Overview includes: Terraform (Open Source), AWS CloudFormation, Azure Resource Manager, GC Deployment Manager. ● YAML vs JSON. ● Deploy stack and changeset. ● Case study: AWS CloudFormation deployment of EC2.	Hands-on: Building a full system and infrastructure using AWS formation and Terraform. Submission: Terraform files, Screenshots + pdf. Assignment M4-1 due Assignment M5-1 out Quiz M5-1.
11	Mar 17	M6	Cloud Storage and Databases (Focused on AWS): ● Object Store (S3/Glacier). ● EFS, FSx, EBS. ● Databases ○ RDS (SQL) ○ DynamoDB (KV, NoSQL)	Hands-on: Cloud Storage including RDS, S3, EFS, EBS, Vault, DynamoDB. Submission: Screenshots + pdf. Assignment M5-1 due Assignment M6-1 out Quiz M6-1

12	Mar 24	M7	Networking and Security in Cloud Computing: • Virtual Private Cloud (VPC) architecture and configuration. • AWS CloudFront for content delivery and caching. • Route 53 DNS management and traffic routing. • Hybrid networking with Direct Connect and VPN. • Cloud security best practices and services (WAF, Shield, IAM).	Hands-on: Cloud Networking, VPC, subnets, security groups, logging and monitoring, various security services. Submission: Screenshots + pdf. Assignment M6-1 due Assignment M7-1 out Quiz M7-1
13	Mar 31	M8	Overview and hands-on of popular AWS Managed Services: ● Route53 (DNS) CloudFront (CDN) ● Lambda, Aurora, DynamoDB, Redshift, Neptune, Analytics (Glue, Sagemaker, Athena, QuickSight), Lake Formation, CloudWatch (monitoring and logging), Realtime processing (Kinesis: Sharding and on Demand).	Hands-on: Overview of additional serverless services for building data and machine learning pipelines, web services, compliance, real time processing. Submission: Screenshots + pdf. Assignment M7-1 due Quiz M8-1
14	Apr 7	M9	Cloud Architecture: ● AWS well-architected Framework. Monolithic vs Microservices. VPC. ● Global infrastructure: Region, Availability Zone, Load Balancing. ● Disaster recovery (DR). ● Use case: eCommerce application architecture.	Hands-on: Overview of case studies for end-to-end systems built in the cloud (public and private).
15	**Apr 14**		**Demo Day**	Demo Projects.

16	**April 21**		**Final Exam**
Note: If the lecture falls on a holiday or canceled for any reason, the topic moves directly to the week after. Note: Quizzes are multiple choice using Canvas (Quiz functionality). Quizzes will be scheduled outside the classroom.			

Grading Policy:

Category	**Weight**	**Comment**
Assignments	15%	Assigned on Canvas.
Hands-on Labs (AWS Academy)	15%	Login to AWS Cloud Foundation Course on AWS Academy Canvas will be provided.
Quizzes	15%	Assigned on Canvas.
Midterm	25%	In Person Exam
Final Exam	30%	In Person Exam
Optional Extra Credit Project	-	Up to 10 Points Extra Credit Added over the final total of 100.
TOTAL	100%	+10 Points Extra Credit.

Grading Scale:

92 - 100% A	86 - 88% B+	76 - 78% C+	Below 70% F
	82 - 85% B	72 - 75% C	
89 - 91% A-	79 - 81% B-	70 - 71% C-	

AWS Academy: It is an excellent supporting resource for this course. Each student will receive access to the course “Cloud Foundation” on AWS Academy. The platform is a Canvas LMS platform. You will be assigned assignments from AWS Academy Hands-on Labs that will count toward the “AWS Hands-on Labs Category.

Private Cloud Access: The private cloud access will be limited. It will be provided on an as-needed basis for students who require additional access that may not be available otherwise.

Class Recording Policy:

Recording of any kind, including voice and video, is strictly prohibited during classes unless explicit prior permission is granted by the instructor. This policy complies with applicable laws and respects the privacy and intellectual property rights of all participants.

Attendance/Late Work Policy

Attendance Policy

Students registered in MGEN courses (INFO, CSYE, and DAMG) are allowed **a maximum of 2 absences per course, with 3 or more absences resulting in an automatic 'F' for that course.** Students are expected to inform their instructors of any absences in advance of the class; if a student is sick long-term or experiences a medical issue that prevents class attendance, it is strongly encouraged that they speak with their Academic Advisor (coe-mgen-gradadvising@northeastern.edu) to learn more about the Medical Leave of Absence. Should a student anticipate being unable to attend 3 or more classes, they should discuss their situation with their Academic Advisor to explore other types of leave in accordance with the University's academic and global entry expectations. International students should review the Office of Global Services webpage to understand their visa compliance requirements.

Teaching Assistants (TAs) or Instructional Assistants (IAs) will be present at each class to collect student attendance.

Late Work Policy

Students must submit assignments by the deadline in the time zone noted in the syllabus. **No late work will be accepted**. Each student is responsible for proper planning and submitting on time.

End-of-Course Evaluation Surveys
Your feedback regarding your educational experience in this class is particularly important to the College of Engineering. Your comments will make a difference in the future planning and presentation of our curriculum.

At the end of this course, please take the time to complete the evaluation survey at **https://neu.evaluationkit.com**. Your survey responses are **completely anonymous and confidential**. For courses 6 weeks in length or shorter, surveys will be open one week prior to the end of the courses; for courses greater than 6 weeks in length, surveys will be open for two weeks. An email will be sent to your Northeastern University Mail account notifying you when surveys are available.

Academic Integrity
A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

Go to http://www.northeastern.edu/osccr/academic-integrity-policy/ to access the full academic integrity policy.

MGEN Student Feedback
Students who would like to provide the MGEN unit with anonymous feedback on this particular course, Teaching Assistants, Instructional Assistants, professors, or to provide general feedback regarding their program, may do so using this survey: https://neu.co1.qualtrics.com/jfe/form/SV_cTIAbH7ZRaaw0Ki

University Health and Counseling Services
As a student enrolled in this course, you are fully responsible for assignments, work, and course materials as outlined in this syllabus and in the classroom. Over the course of the semester if you experience any health issues, please contact UHCS.

For more information, visit https://www.northeastern.edu/uhcs.

Student Accommodations
Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability.
For more information, visit https://drc.sites.northeastern.edu.

Library Services
The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals.

For more information and for education specific resources, visit https://library.northeastern.edu
Network Campus Library Services: Northeastern University Library Global Campus Portals

24/7 Canvas Technical Help
For immediate technical support for Canvas, call 617-373-4357 or email help@northeastern.edu

Canvas Student Resources: https://canvas.northeastern.edu/student-resources/

For assistance with my Northeastern e-mail, and basic technical support:
Visit ITS at https://its.northeastern.edu

Email: help@northeastern.edu
ITS Customer Service Desk: 617-373-4357

Diversity and Inclusion
Northeastern University is committed to equal opportunity, affirmative action, diversity, and social justice while building a climate of inclusion on and beyond campus. In the classroom, members of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration, and an awareness of global perspectives on social justice.

Please visit http://www.northeastern.edu/oidi/ for complete information on Diversity and Inclusion

Title IX
Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance.

Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty, and staff.

In case of an emergency, please call 911.

*Please visit **https://www.northeastern.edu/ouec** for a complete list of reporting options and resources both on- and off-campus.*

Syllabus Changes: The instructor reserves the right to modify the syllabus, including course content, assignments, grading criteria, and schedule, as deemed necessary to enhance the learning experience or respond to unforeseen circumstances. Any changes will be communicated to students in a timely manner through official channels. It is the responsibility of the students to stay informed about such updates.