CS 402: Distributed Systems
& Cloud Architecture

Department of Computer Science | Synapse University | Fall 2026

4 Credit Hours
Lecture & Lab
Prereq: CS 301

Instructor Information

Instructor: Prof. Elena Rostova
Email: e.rostova@synapse.edu
Office: Turing Hall, Room 412
Office Hours: Tue / Thu 2:00 PM – 4:00 PM
Website: synapse.edu/cs402

Course Logistics

Lectures: Mon / Wed 10:00 AM – 11:30 AM
Location: Meridian Science Center 104
Lab Session: Friday 1:00 PM – 3:00 PM
Lab Location: Apex Computing Lab 2
Teaching Asst: Marcus Vance (m.vance@synapse.edu)

Course Overview & Objectives

CS 402 provides an in-depth study of distributed algorithms, cloud infrastructure design, and scalable system architecture. Students will explore fundamental principles governing consensus, fault tolerance, replication, and distributed storage. Hands-on laboratory assignments will focus on building robust services using modern microservices design patterns.

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

1. Analyze and apply classic distributed consensus protocols such as Raft and Paxos.
2. Architect fault-tolerant storage engines leveraging consistent hashing and event-driven messaging.
3. Evaluate performance trade-offs under CAP theorem constraints and eventual consistency models.
4. Deploy and monitor containerized microservices across cloud clusters using modern orchestrators.

Prerequisites & Course Materials

- **Required Text:** *Designing Scalable Distributed Systems*, 3rd Ed., Rostova & Vance, Vertex Academic Press, 2024.
- **Recommended Reference:** *Cloud Architecture Guidelines*, Meridian Press, 2025.
- **Software Tools:** Docker, Kubernetes local cluster (minikube/k3s), Go programming environment (v1.22+), Git.

Assessment & Grading Policy

Grade Breakdown

Assessment Component	Weight
Programming Projects (4)	35%
Weekly Lab Exercises	15%
Midterm Examination	20%
Final Capstone Project	20%
Class Participation & Quizzes	10%

Letter Grade Scale

Grade	Range	Grade	Range
A	93 – 100%	C+	77 – 79%
A-	90 – 92%	C	73 – 76%
B+	87 – 89%	C-	70 – 72%
B	83 – 86%	D	60 – 69%
B-	80 – 82%	F	< 60%

Course Policies & Expectations

Late Submission Policy: Assignments submitted up to 24 hours past the deadline incur a 10% penalty. Assignments submitted 24–48 hours late incur a 25% penalty. Submissions beyond 48 hours will not be accepted without prior academic accommodation.

- **Academic Integrity:** All submitted code and written work must be your own original effort. Collaborations must adhere strictly to the Synapse Academic Honor Code. Unauthorized use of code-generation tools during exams is prohibited.
- **Attendance & Participation:** Active involvement in lectures and lab sessions is vital. Quizzes will occur randomly during Monday lectures.
- **Accommodations:** Students requiring disability accommodations should contact the Student Accessibility Office during the first week of class.

Course Schedule & Lecture Calendar

Wk	Dates	Topic & Core Concepts	Deliverable / Assessment
1	Sep 07, 09	Introduction to Distributed Systems & RPC Architecture	Lab 0: Dev Environment Setup
2	Sep 14, 16	Clock Synchronization, Logical Clocks & Vector Clocks	Project 1 Release (gRPC Engine)
3	Sep 21, 23	Distributed Consensus: Paxos Foundations	Quiz 1 (Mon)
4	Sep 28, 30	Practical Consensus: Raft Protocol & Leader Election	Lab 1 Due (Sep 30)
5	Oct 05, 07	Distributed Key-Value Stores & Consistent Hashing	Project 1 Due (Oct 07)
6	Oct 12, 14	CAP Theorem, Eventual Consistency & Dynamo Model	Project 2 Release (Raft Cluster)
7	Oct 19, 21	Midterm Review & **Midterm Exam (Oct 21)**	Midterm Exam
8	Oct 26, 28	Distributed Transactions, 2PC & Saga Pattern	Lab 2 Due (Oct 28)
9	Nov 02, 04	Cloud Virtualization, Containers & Orchestration	Project 2 Due (Nov 04)
10	Nov 09, 11	Storage Engines, LSM Trees & Distributed File Systems	Project 3 Release (K8s Operator)
11	Nov 16, 18	Message Queues, Event Streaming & Kafka Architecture	Lab 3 Due (Nov 18)
12	Nov 23, 25	Thanksgiving Recess (No Class Nov 25)	Project 3 Due (Nov 24)
13	Nov 30, Dec 02	Fault Injection, Chaos Engineering & Observability	Capstone Proposals Due
14	Dec 07, Dec 09	Cloud Security, Identity & Zero Trust Architecture	Capstone Final Presentations
15	Dec 14	**Final Capstone Submission & Code Review**	Capstone Project Due (Dec 14)