Rowan College at Burlington County

Course Syllabus

Division of Science and Mathematics			
Department	Computer Science		
Faculty Member			
Course Title	Advance Cloud Systems, DevOps, and Systems		
Course Number	CIS160	**Credits**	4
Prerequisites	CIS138, CIS 113		
Co-requisite	CIS150		
# of Lecture Hours	3	**# of Lab Hours**	2
Semester		**Location**	
Course Start Date		**Course End Date**	
Meeting Information			

Faculty Contact Information	

Campus Resources	
Transfer Center	Evans Hall, Room 172 Monday - Friday: 8:30 am - 5 pm transfer@rcbc.edu (856) 2229311, ext. 2737
Career Services Center	Student Success Center Monday - Friday: 9 am - 5 pm (856) 222-9311, ext. 2056 CareerServices@rcbc.edu

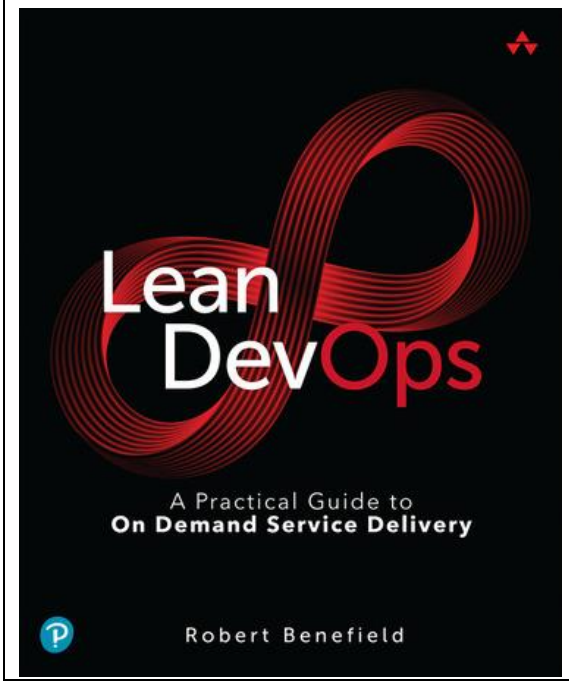
Tutoring Center	Student Success Center, Room 209 (856) 222-9311, ext. 2096 Monday: 9:30 am - 4 pm Tuesday: 9:30 am - 4 pm Wednesday: 9:30 am - 4 pm Thursday: 9:30 am - 4 pm Friday: Closed Saturday: 9:30 am - 1:30 pm Sunday: Closed

Course Description

This course provides the advanced skills and knowledge required to excel in the rapidly evolving fields of cloud computing and DevOps. Focusing on advanced principles of cloud computing and DevOps, the course offers a deep dive into designing, deploying, and managing scalable, highly available, and fault-tolerant systems on cloud platforms. Alongside this, it integrates core DevOps principles, emphasizing automation, continuous integration (CI), continuous delivery (CD), infrastructure as code (IaC), and effective team collaboration practices. It covers knowledge domains for advanced certifications in cloud and DevOps.

Required Text and Other Materials

Lean DevOps: A Practical Guide to On Delivery, 1st edition
Published by Addison-Wesley Professional (June 29, 2022) © 2023
ISBN-13: 9780133853667



Course Learning Outcomes
Upon completion of this course, students will be able to: a. Apply the DevOps methodology, focusing on automation, continuous integration/Deployment, monitoring, and security practices. b. Implement cloud management and DevOps tools for seamless development and deployment of applications on the cloud. c. Leverage advanced cloud computing features and services to design sophisticated cloud-based solutions.
Course Objectives
The value of designing and deploying scalable, highly available, and fault-tolerant systems in cloud computing. Comprehend continuous delivery systems and methodologies in cloud computing. Learn core principles of DevOps practices for effective team collaboration and automation.
General Learning Outcomes
• Written and Oral Communication: Communication 1. Students will logically and persuasively support their points of view or findings. 2. Students will demonstrate competency in office productivity tools appropriate to continuing their education. 3. Students will use critical thinking skills for computer-based access, analysis, and presentation of information. 4. Students will exhibit competency in library online database tools appropriate to accessing information in reference publications, periodicals and bibliographies. 5. Students will demonstrate the skills required to find, evaluate, and apply information to solve a problem.

CLO (Course Learning Outcomes to PLO (Program Learning Outcomes) Mappings

CLO	GLO				
	1	2	3	4	5
A					X
B			X		
C				X	
D			X		
E	X				

SECTION 2:

Course and Classroom Policies:

Expectations: Students are expected to attend class, be prepared having read the text chapter beforehand, complete assignments, and to participate in discussions. Students are expected to complete and submit assignments on or before the due date. Students are expected to conduct themselves in a professional manner in classes and labs.

Required email: Students are assigned an email account by the college (*firstname_lastname@mymail.rcbc.edu*). Students are expected to use this account to correspond with the instructor and to include CIS ###(### represent the course number) in the subject line. Attendance:

- Students are expected to attend all classes.
- Coming to class late and/or leaving class early without prior permission from the instructor will be counted as an absence.
- All materials will be collaborated as in class exercises and discussions. Attending all classes is the key to success in this class, since all projects/exams will be based on those materials that are covered in the class. Computer Usages
- Students are not allowed to use computers for any other purposes except for lecture notes during lectures and for practical.
- Student will be asked to leave the room if he or she persists to use a computer.
- Printing is not permitted during lectures.

Late Work Policy

- All course work must be completed by the deadline, if it is not submitted by the deadline the following will occur:
    - A total of 10 points will be deducted for each week until the 5th week after the 5th week a student will receive a grade of 0.
    - All late work must be submitted via Blackboard no work should be e-mailed to the instructor.

Requesting Work

- If a student has prior engagements, that student can request to have work completed and submitted so the work can be submitted on time

Criteria for Grade Determination:

Project

The course project showcases the student's skills in configuring, troubleshooting, designing, and testing a computer network. It will also assess their abilities in writing, documentation, and research. The project aims to reflect real-world applications and prepare students for entry-level IT positions. A rubric will be utilized for grading purposes.

Class Participation

Class participation can include attendance, seeking help from the instructor or tutor, and participating in classroom activities.

Weighting of Assessments: A student's final grade in the course will be determined using the following percentage:

Course Project	25%
Lab Project Assignments	45%
Discussion	15%
Final Exam	15%
Total	100%

Grade Determination:

A	= 90-100%
B+	= 85-89.99%
B	= 80-84.99%
C+	= 75-79.99%
C	= 70-74.99%
D	= 60-69.99%
F	< 60%

Rowan College at Burlington County

Course Syllabus

Tentative Schedule

15-Week Course Outline/Hybrid/Resident

	Lecture Topics	Hands-on AWS Academy	Discussions
Week 1	Chapter 1: The Problem with IT Service Delivery 7 Approach #1: Reduce Delivery Friction 9 The Downsides of Targeting Delivery Friction 11 Approach #2: Managing Service Delivery Risk 12 The Downsides of Targeting Service Delivery Risk 14 The Essence of Delivery 15 Beginning the DevOps Journey 17	AWS Academy Cloud Developing Module 1: Welcome to AWS Academy Cloud Developing Module 2: Introduction to Developing on AWS	Regarding Module 1, "Welcome to AWS Academy Cloud Developing," what are the primary aims and anticipations for learners as they begin their academic voyage? In what ways does this module establish the foundation for comprehending the broader significance and context of cloud development within the AWS ecosystem?

			In Module 2, "Introduction to Developing on AWS," students are introduced to fundamental concepts and abilities as they commence their exploration of the pragmatic elements associated with developing on the AWS platform. How does this module equip students with the knowledge and skills necessary to effectively navigate the tools, services, and optimal methodologies critical to the accomplishment of cloud-based development projects?
Week 2	Chapter 2:How We Make Decisions 21 Examining the Decision-Making Process 22 Boyd and the Decision Process 23 The OODA Loop 26 The Ingredients of Decision Making 29 Ingredient 1: The Target Outcome 30 Delivering Measures over Outcomes 36 Ingredient 2: Friction Elimination 39 Ingredient 3: Situational Awareness 42 The Challenge of Trust 44 The Fragility of Mental Models and Cognitive Biases 45	AWS Academy Cloud Developing Module 3: Developing Storage Solutions Module 4: Securing Access to Cloud Resources	In designing storage solutions for cloud-based applications, developers ought to consider specific factors to guarantee scalability, durability, and cost-efficiency. How can utilizing diverse storage services provided by cloud providers be optimized to

	Ingredient 4: Learning 48 Failing to Learn 48 The Pathway to Improved Decision Making 53 Summary 54		fulfill the particular demands of applications? What are the most effective strategies for establishing strong authentication and authorization mechanisms to safeguard against unauthorized access and data intrusions when securing access to cloud resources? In what ways can developers effortlessly incorporate security protocols into their cloud-based applications to protect confidential information and guarantee adherence to regulatory obligations?
Week 3	Chapter 3:Mission Command 55 The Origins of Mission Command 56 Learning How to Lead Effectively the Hard Way 57 Managing Through Unpredictability 58 Knowledge and Awareness Weaknesses 59 Misalignments 60 Misjudgment of Ecosystem Complexity 61	AWS Academy Cloud Developing Module 5: Developing Flexible NoSql Solutions Module 6: Developing REST APIs	In developing flexible NoSQL solutions, which factors should be considered when determining which NoSQL database type is most suitable for a given application, considering particulars like scalability,

	The Anatomy of Mission Command 62 Commander's Intent 63 Brief 66 Situational Overview 67 Statement of the Desired Outcome or Overall Mission Objective 67 Execution Priorities 67 Anti-Goals and Constraints 68 Backbriefing 69 Einheit: The Power of Mutual Trust 71 Creating Einheit in DevOps 74 Continual Improvement 75 Staff Rides 78 After Action Reviews 79 Organizational Impacts of Mission Command 80 Summary 81		data structure, and query flexibility? How can developers evolve NoSQL database designs and implementations to accommodate changing application requirements and data models? What are the most crucial design principles and best practices developers should adhere to when creating REST APIs? These factors guarantee scalability, maintainability, and seamless integration with client applications. How can developers ensure a consistent and intuitive user experience while optimizing REST API endpoints for security and performance?
Week 4	Chapter 4:Friction 83 Understanding Ohno's Forms of Waste 84 Muda (Pure Waste) 86 Muri (Overburden) 109 Mura (Fluctuation and Irregularity) 113	AWS Academy Cloud Developing Module 7: Developing Event-Driven Serverless Solutions Module 8: Introducing Containers and Containers Services	Developers should recognize fundamental architectural considerations and design patterns when creating event-driven serverless solutions. These elements are crucial for

	See the Whole 125 Summary 126		optimizing the utilization of serverless computing in managing asynchronous events and dynamically scaling applications. How can event-driven architectures improve the responsiveness and efficacy of diverse use cases, including IoT applications and real-time data processing? Concerning the introduction of containers and container services, what are the principal advantages and obstacles to deploying and administering applications via containerization? How can developers leverage container orchestration platforms such as Kubernetes to optimize resource utilization, expedite the development lifecycle, and guarantee scalability and dependability?

Week 5	Chapter 5:Risk 127 Cynefin and Decision Making 128 Ordered Systems 131 Unordered Systems 134 Reimagining Risk Management 143 Have Clear and Understood Target Outcomes 144 Make the Best Choice the Easiest Choice 145 Continually Improve Ecosystem Observability 147 Summary 151	AWS Academy Cloud Developing Module 9: Caching Information for Scalability Module 10: Developing with Messaging Services	1. When caching information for scalability, what are the key considerations for selecting an appropriate caching strategy based on the application's access patterns, data consistency requirements, and scalability goals? How can developers effectively implement caching mechanisms to improve performance and reduce latency while maintaining data integrity and consistency across distributed systems?

			2. In the context of developing with messaging services, what are the advantages of using messaging queues or brokers for asynchronous communication between microservices or distributed components? How can developers design and integrate messaging patterns such as publish-subscribe or message queues to decouple application components, enhance fault tolerance, and support scalable and resilient architectures?

Week 6	Chapter 6:Situational Awareness 153 Making Sense of Our Ecosystem 154 The Mental Model 157 The Problems with Mental Models 158 Cognitive Bias 161 Gaining Better Situational Awareness 163 Framing 164 Finding and Fixing Framing Problems 165 Information Flow 169 Why Ecosystem Dynamics Matter 169 Meeting Your Information Flow Needs 172 Analysis and Improvement 181 Summary 182	AWS Academy Cloud Developing Module 11: Defining Workflows to Orchestrate Functions Module 12: Developing Secure Applications on AWS	What are the benefits of utilizing serverless orchestration tools, such as AWS Step Functions or AWS Lambda, to coordinate executing distributed tasks or microservices when defining workflows to orchestrate functions? What strategies can developers employ in cloud environments to architect workflow designs that guarantee visibility into the execution flow of serverless functions, scalability, and defect tolerance? When designing, deploying, and administering applications in the AWS cloud, what are the most important security considerations that developers must consider when developing secure applications on AWS? How can developers implement best security practices such as encryption, identity and access management, and continuous monitoring to

			protect AWS-hosted applications from potential threats and vulnerabilities?
Week 7	Chapter 7:Learning 183 The Emergence of Skills Attainment Learning 184 The Rise of the One Right Way 186 Outcome-Directed Learning 188 Creating a Learning Culture 191 Day-to-Day Kata 191 Improvement and Problem-Solving Kata 192 The Coaching Practice 193 Summary 195	AWS Academy Cloud Developing Module 13: Automating Deployment Using CI/CD Pipelines Module 13: Bridging to Certifications	How can software application deployment be streamlined by implementing CI/CD pipelines through the automation of code integration, testing, and deployment tasks? Regarding software development workflows, what are the primary advantages and obstacles that arise from implementing CI/CD pipelines, and how can organizations integrate them efficiently into their development processes? In what ways do the fundamental elements of a CI/CD infrastructure facilitate the automation of software application deployment? How can software developers optimize and streamline

			CI/CD pipelines to facilitate accelerated release cycles, enhance code quality, foster collaboration among development teams, and guarantee consistent and dependable deployment procedures?
Week 8	Chapter 8:Embarking on the DevOps Journey 197 The Service Delivery Challenge 204 Traditional Delivery Fog in the Service World 205 The Challenge of the "ilities" 207 The Path to Eliminating Service Delivery Fog 209 The Role of Managers in Eliminating Service Delivery Fog 210 Identifying What You Can or Cannot Know 214 Ways the Team Can Eliminate Service Delivery Fog 219 Summary 220	AWS Academy Lab Project - Microservices and CI/CD Pipeline Builder	What are the potential implications of integrating microservice architecture into CI/CD pipeline design and implementation? In constructing CI/CD pipelines for microservices-based applications, which particular challenges and factors should developers bear in mind, and how can they utilize automation to effectively handle the intricacies associated with the deployment and scalability of individual microservices? To expedite the automation of the build, test, and deployment processes, which are the essential

			features and functionalities developers should seek in a CI/CD Pipeline Builder tool utilized for microservices deployment? How can organizations best accommodate individual microservices' distinct requirements and dependencies while maintaining consistency and standardization throughout CI/CD pipelines?
Week 9	Chapter 9:Service Delivery Maturity and the Service Engineering Lead 221 Modeling Service Delivery Maturity 223 The Example of Measuring Code Quality 224 Service Delivery Maturity Model Levels 225 Service Delivery Maturity Areas of Interest 228 Configuration Management and Delivery Hygiene 232 Supportability 235 Single Point of Failure Mitigation and Coupling Management 239 Engagement 241 The Service Engineering Lead 243 Why Have a Separate Rotating Role? 244	AWS Academy Lab Project - Cloud Security Builder	Which capabilities and features should organizations using a Cloud Security Builder tool prioritize to strengthen the security posture of their cloud infrastructure and applications? How can these tools facilitate the automation of security best practices—including identity and access management, encryption, and threat detection—to lower risks and ensure compliance with industry regulations?

	How the SE Lead Improves Awareness 246 Organizational Configurations with the SE Lead 248 Challenges to Watch Out For 250 Incentivizing Collaboration and Improvement 251 Developers Running Production Services 253 Overcoming the Operational Experience Gap 254 Summary 256		What is the influence of integrating a Cloud Security Builder tool on a cloud-based organization's comprehensive security strategy and risk management methodology? To establish secure and resilient security frameworks, which organizations should prioritize security automation challenges and considerations when integrating it into their cloud environments, and how can they ensure that security initiatives align with business objectives?
Week 10	Chapter 10:Automation 257 Tooling and Ecosystem Conditions 258 Building Sustainable Conditions 260 5S 261 Seeing Automation 5S in Action 278 Tools & Automation Engineering 283 Organizational Details 285 Workflow and Sync Points 285 Summary 287	AWS Academy Lab Project - Cloud Data Pipeline Builder	Which functionalities and features should organizations use a Cloud Data Pipeline Builder tool to prioritize to optimize the data ingesting, processing, and transformation process across various cloud services and data sources? How can these tools assist in ensuring data quality and

			governance while addressing common data integration challenges such as scalability, real-time processing, and data consistency? How does an organization deploying a Cloud Data Pipeline Builder tool affect the agility and productivity of data-driven initiatives? When designing and implementing data pipelines in the cloud, which factors should organizations prioritize above all else and adhere to as best practices? How can organizations utilize automation to expedite the time required to gain insights and facilitate well-informed decision-making?
Week 11	Chapter 11:Instrumentation and Observability 289 Determining the "Right" Data 291 Know the Purpose and Value 293 Know the Audience 297 Know the Source 302	AWS Academy Lab Project - Cloud Web Application Builder	

	Making the Ecosystem Observable 307 Instrumenting for Observability 310 Instrumenting Development 310 Instrumenting Packaging and Dependencies 314 Instrumenting Tooling 316 Instrumenting Environment Change and Configuration Management 317 Instrumenting Testing 319 Instrumenting Production 320 Queryable/Reportable Live Code and Services 321 Presenting Task, Change, Incident, and Problem Records Together 321 Environment Configuration 322 Logging 323 Monitoring 324 Security Tracking and Analysis 325 Service Data 326 Pulling It All Together 327 Instrumenting a Wastewater Ecosystem 328 Instrumenting an IT Ecosystem 331 Summary 333		
Week 12	Chapter 12:Workflow 335 Workflow and Situational Awareness 336 Managing Work Through Process 337 Managing Work Organically 339 The Tyranny of Dark Matter 340 Learning to See the Disconnects in Action 343 Resolving Disconnects by Building	AWS Academy Explore Solutions with the Cloud	

	Context 347 Visualizing the Flow 349 Workflow Board Basics 351 State Columns 352 State Columns for Operations 353 Swim Lanes 355 Task Cards 358 Preventing Dark Matter 359 Using the Board 362 Seeing the Problems 363 Limiting Work in Progress 365 The Limits of a Workflow Board 367 Managing the Board 367 Managing Flow and Improvement 368 Summary 368		
Week 13	Chapter 13:Queue Master 371 An Introduction to the Queue Master 372 Role Mechanics 374 "Follow the Sun" Queue Mastering 384 Queue Master Rollout Challenges 389 Team Members Don't See the Value 389 More Traditionally Minded Managers Thwarting Rollout 390 Pushy Queue Masters 391 Junior Team Members as Queue Masters 391 Queue Masters Who Struggle to Lead Sync Points 394 Summary 394	Final Project – Advance Architecting and DevOps	
Week 14	Chapter 14:Cycles and Sync Points 395 Inform, Align, Reflect, and Improve 396 Top-Down Alignment Control Approach	Final Presentations	

	397 Alignment Through Iterative Approaches 397 Service Operations Synchronization and Improvement 400 The Tactical Cycle 400 Important Differences Between Kickoffs and Sprint Planning 404 Daily Standup 408 Retrospective 411 General Meeting Structure 413 The Learning and Improvement Discussion 415 The Strategic Cycle 421 Strategic Review 424 General Review Structure 426 A3 Problem Solving for the Strategic Review 427 Summary 432		
Week 15	Chapter 15:Governance 433 Factors for Successful Governance 434 Meeting Intent 435 No Target Outcome Interference 437 Maintain Situational Awareness and Learning 438 Common Governance Mistakes 440 Poor Requirement Drafting and Understanding 440 Using Off-the-Shelf Governance Frameworks 445 Out-of-the-Box Process Tooling and	Final Exam	

Rowan College at BURLINGTON COUNTY

Course Syllabus

SECTION 3: COLLEGE RESOURCES

College Policies

In order for students to know their rights and responsibilities, all students are expected to review and adhere to all regulations and policies as listed in the College Catalog and Handbook. These documents can be accessed at http://www.rcbc.edu/publications. Important policies and regulations include, but are not limited, to the following:

- Grading Standards ○ Withdraw (W) and Incomplete Grade (I) ○ Withdrawal date for this semester
- Student Code of Conduct
- Use of Communication and Information Technology
- College Attendance Policy ○ Students are required to attend all class, clinical, laboratory, and studio sessions for the full duration of each such instructional session. Faculty are required to record student attendance, and grade penalties for absence will be imposed when a student exceeds a ten percent non excused absence rate, not to exceed 10% of the final grade. ○ For all on-campus courses, including hybrid and hybrid-mixed-mode on-campus meeting days, excused absences include: suspected COVID-19 related illness (i.e., exhibiting symptoms), tested positive for COVID-19, or demonstrated need to quarantine. For all VLC courses and hybrid and hybridmixed-mode virtual meeting days, excused absences include: suspected COVID-19 related illness (i.e., exhibiting symptoms that prevent the student from participating online).
    - ○ Students are responsible for informing their instructor as soon as the situation is known and following all other guidelines as outlined by the college. Failure to do so may lead to the absence not being excused. Students are also responsible for communicating with instructors to make reasonable arrangements for the completion of course requirements not completed due to absence.

- Academic Dishonesty/Plagiarism ○ Specifically, the term “plagiarism” includes, but is not limited to, the use by paraphrase direct quotation, of the published or unpublished work or sections of a work of another person without full and clear acknowledgement, whether intentional or not. This includes any material copied directly or paraphrased from the internet. Plagiarism also constitutes the unacknowledged use of materials prepared by another person or agency engaged in the selling of a term papers or other academic materials, including material taken from or ordered through the Internet. For more information on academic dishonesty/plagiarism see Board Policy #903-C.

Office of Student Support and Disability Services

In accordance with Section 504 of the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA) and the ADA Amendments Act, the Student Support Services Office's mission is to ensure all students with disabilities are provided access to educational and extracurricular activities while on college premises through support in the form of reasonable accommodations such as adaptive technology, counseling, note-taking assistance, and American Sign Language interpreters. Students who have disabilities must self-identify, provide documentation of disability(ies), attend an intake appointment, and sign a Disability Release Form (rcbc.edu/studentsupport) prior to the start of the semester to ensure reasonable accommodations. For more information, please contact the Office of Student Support at ext. 1208. For additional information on this policy please refer to the current catalog.

Educational Technology Statement

Rowan College at Burlington County (RCBC) advocates the use of technology to enhance instruction. Students should assume that classroom and online technology will be used throughout their coursework at RCBC, as it will most certainly be used in their future education and careers. The College provides on-campus facilities for the convenience of the RCBC community. Various college departments, including the Office of Information Technology and the Office of Distance Education, provide technology training and assistance to faculty and students.

Student Success Services

RCBC offers a variety of free services for its students including those listed below. Descriptions of these services, as well as many others, can be found in the College Catalog and Handbook and on the RCBC website at https://www.rcbc.edu/students.

- **Academic Advising (**https://www.rcbc.edu/advising**)**
- **Struggling Personally or Academically** (https://rcbc.edu/need-help-now)
- **Career Services (**https://www.rcbc.edu/careers**)**
- **EOF (**https://www.rcbc.edu/eof**)**
- **Financial Aid (**https://www.rcbc.edu/financial-aid**)**
- **International Students Office (**https://www.rcbc.edu/internationall**)**
- **ESL Advising & Support (**https://rcbc.edu/esl)
- **Library (**https://www.rcbc.edu/library**)**
- **Office of Veteran Services (**https://www.rcbc.edu/vets**)**
- **RCBC Foundation -Scholarship information (**https://www.rcbc.edu/foundation**)**
- **RCBC bookstore (**https://www.rcbc.edu/bookstore**)**
- **Rowan University Partnership (**https://www.rcbc.edu/rowan**)**
- **Student Support Counseling (**https://www.rcbc.edu/counseling)
- **Tutoring (**https://www.rcbc.edu/tutoring**)**
- **Test Center (**https://www.rcbc.edu/test-center)
- **Transfer Services (**https://www.rcbc.edu/transfer**)**

This syllabus is subject to change at the instructor's discretion.