

COURSE TITLE	INTRODUCTION TO DEVOPS TOOLS
COURSE CODE	01CT0728
COURSE CREDITS	4

Objective:

- 1 The objective of this course is to develop fundamental and practical skills in DevOps principles, tools, and practices for designing, automating, and managing software delivery pipelines using modern technologies including cloud platforms like Amazon Web Services, CI/CD, and containerization

Course Outcomes: After completion of this course, student will be able to:

- 1 Analyze software development workflows to identify gaps and inefficiencies in continuous integration and delivery pipelines.
- 2 Evaluate the roles, responsibilities, and skill sets required in DevOps teams for achieving continuous delivery.
- 3 Design and deploy automated testing strategies across the development lifecycle to improve software quality.
- 4 Analyze and apply modern system operations practices, including monitoring, deployment, and infrastructure management using DevOps tools.
- 5 Evaluate DevOps practices and methodologies to enhance team productivity and achieve reliable continuous delivery
- 6 Design and deploy iterative improvements to a software delivery pipeline by applying DevOps principles and automation tools to enhance efficiency, reliability, and scalability.

Pre-requisite of course:Cloud computing, Linux Administrator

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	DevOps Fundamentals, Linux & Networking DevOps Concepts, Lifecycle, and Benefits, Agile vs DevOps, Introduction to Cloud Computing, Linux Basics and Server Management, Shell Commands and System Administration, Networking Fundamentals (OSI, TCP/IP, DNS, Ports, Protocols), Virtualization and Environment Setup using Vagrant	5
2	Scripting, Data Formats & Version Control YAML and JSON Fundamentals, Bash Scripting for Automation, AI-assisted scripting using GitHub Copilot, Version Control using Git, Repository Management with GitHub, Introduction to Build Tools (Apache Maven)	5

Contents : Unit	Topics	Contact Hours
3	Cloud Computing with AWS AWS Fundamentals and Global Infrastructure, IAM (Identity and Access Management), Compute: EC2, Storage: S3, EBS, Database: RDS, Networking: VPC, ELB, Route 53, Monitoring: CloudWatch, Automation: Lambda, Auto Scaling, Systems Manager and Amazon Q, Overview of Amazon Web Services ecosystem	6
4	CI/CD and DevOps Tools Continuous Integration and Continuous Deployment, CI/CD Pipelines Design Tools: Jenkins, GitHub Actions, GitLab CI/CD, Artifact Management using Nexus Repository, Code Quality using SonarQube, Integration with Slack	10
5	Automation, IaC & Configuration Management Python Basics for DevOps Automation, AWS Automation using Python (Boto3 basics), Infrastructure as Code using Terraform, Modules, Backends, and State Management, Configuration Management using Ansible	6
6	Containers, Monitoring & Advanced DevOps Containerization using Docker, Orchestration using Kubernetes, Helm and Production Deployment, Monitoring with Prometheus and Grafana, Logging with Loki and Alerting, AWS DevOps Services (CodeCommit, CodeBuild, CodePipeline, Beanstalk), GitOps Workflow (End-to-End Project)	10
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment-1 Analyze the differences between Agile and DevOps by mapping lifecycle stages to a real-world software project. Evaluate Linux file permission strategies for multi-user environments and justify optimal configurations.	2
2	Experiment-2 Analyze system performance using Linux monitoring tools and recommend optimization actions	2
3	Experiment-3 Design a Bash automation script to solve a real-world system administration problem.	2
4	Experiment-4 Evaluate network behavior using diagnostic commands and identify bottlenecks in connectivity.	2
5	Experiment-5 Design a virtualized development environment using Vagrant for a given application scenario.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	Experiment-6 Design and deploy a scalable application architecture using Amazon Web Services EC2 and related services.	2
7	Experiment-7 Analyze code quality metrics using SonarQube and recommend improvements.	2
8	Experiment-8 Design a Python-based automation solution for system or cloud operations	2
9	Experiment-9 Design and deploy a containerized application using Docker and evaluate its performance and scalability.	2
10	Experiment-10 Migrating a Web Application to Docker Containers	2
11	Experiment-11 Design a CI pipeline using Jenkins for automated build and testing.	2
12	Experiment-12 Analyze IAM policies and propose secure access control mechanisms for an organization	2
13	Experiment-13 Automating Application Deployment Using a CI/CD Pipeline.	2
14	Experiment-14 Develop and evaluate infrastructure provisioning using Terraform with modular design	2
15	Experiment-15 Analyze and implement configuration management strategies using Ansible.	2
16	Experiment-16 Create CI/CD pipeline for deploying any project.	2
Total Hours		32

Textbook :

- 1 The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, G. Kim, J. Humble, P. Debois, and J. Willis, USA: IT Revolution Press, 2016
- 2 Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, J. Humble and D. Farley, USA: Addison-Wesley, 2010

References:

- 1 Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations. Portland, Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations. Portland, N. Forsgren, J. Humble, and G. Kim, USA: IT Revolution Press, 2018

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
5.00	5.00	40.00	30.00	10.00	10.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc. for effective teaching.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.
- 4 Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.
- 5 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, Flipped class, Project based learning, Collaborative learning, MOOCs etc. for effective teaching.

Supplementary Resources:

- 1 <https://docs.aws.amazon.com/wellarchitected/latest/devops-guidance/devops-guidance.html>
- 2 <https://builder.aws.com/learn/topics/developer-tools>
- 3 <https://aws.amazon.com/devops/>
- 4 <https://docs.aws.amazon.com/whitepapers/latest/introduction-devops-aws/introduction-to-devops.html>
- 5 <https://www.udemy.com/course/decodingdevops/>