INT331:FUNDAMENTALS OF DEVOPS

L:2 T:0 P:2 Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: understand the need, culture, principles, and lifecycle of DevOps.

CO2 :: use version control and collaborative development using Git & GitHub.

CO3 :: execute automation and continuous integration using industry tools.

CO4 :: create applications using containerization (Docker) and orchestration basics.

CO5 :: understand Infrastructure as Code (IaC) and basic cloud DevOps workflows.

CO6 :: gain exposure to monitoring, logging, and DevOps best practices.

Unit I

Introduction to DevOps (Foundational Concepts) : DevOps Introduction, Evolution of Software Development: Waterfall, Agile, DevOps, Understanding the origin of DevOps, Benefits of cross-functional teams and automation in DevOps, DevOps Goals: Improved Collaboration, Faster Delivery, Reliability, CALMS Framework (Culture, Automation, Lean, Measurement, Sharing), DevOps Principles and Practices, Phases of DevOps Lifecycle,, Key DevOps Roles in Industry, Use Cases in Companies (Netflix, Amazon, Google etc.)

Unit II

Version Control & Source Code Management : Why Version Control?, Git Repositories, Git Cmd/Bash: Git basic operations (add, init, push, pull), Commits, Branching, Merging, tagging, rebasing, stashing., Git Remote Workflows: GitHub Flow, Feature Branch Workflow, Resolving Merge Conflicts, GitHub: Issues, Pull Requests, Discussions

Unit III

Continuous Integration (CI) & Build Automation : CI fundamentals and benefits, CI Pipeline Architecture, Popular CI Tools: Jenkins, GitHub Actions, GitLab CI, CircleCI, Build Tools Overview: Maven, Gradle, npm, Writing Jenkins Declarative Pipelines, Automated Builds, Automated Testing, Test Automation Basics (Unit Testing, Coverage)

Unit IV

Core concepts of Continuous Delivery (CD), Deployment & Automation : Introduction Continuous Delivery & Continuous Deployment, Jenkins Plugins for CD, Deployment Strategies: Rolling, Blue-Green, Canary, Configuration Management Basics: Terraform / Puppet / Ansible, Infrastructure Automation with Ansible and Terraform, Containerization Introduction, Docker Architecture & Workflow, Writing Dockerfiles, Building Images, Running Containers

Unit V

Overview of Container Orchestration and Microservices : Need for Orchestration, Kubernetes Architecture Overview, Basic Kubernetes Concepts: Pods, Deployments, Services, Why Microservices?, Monolithic and Microservice Architecture, Benefits (scalability, independent deployment), Intro to DevOps on AWS/GCP/Azure (conceptual only)

Unit VI

Understanding of Monitoring, Logging, Security & DevOps Best Practices : Need for Monitoring in DevOps, Monitoring Tools: Prometheus & Grafana (overview), Logging Fundamentals: ELK Stack (Elasticsearch, Logstash, Kibana), Observability: Metrics, Logs, Traces, Introduction to DevSecOps, Introduction to Site Reliability Engineering (SRE), DevOps Best Practices, Real Industry Case Studies: Google SRE, Netflix Chaos Engineering, Future of DevOps: GitOps, AIOps, NoOps

List of Practicals / Experiments:

List of Practical

- 1. Installation and Configuration of Git; Performing Basic Version Control Operations.
- 2. Creating and Managing Remote Repositories using GitHub.
- 3. Branch Management, Merging, and Conflict Resolution using Git.
- 4. Collaborative Software Development using GitHub Issues, Forks, and Pull Requests.
- 5. Performing Advanced Git Operations: Stashing, Rebasing, and Tagging.

- 6. Installation of Docker and Execution of Basic Container Management Commands.
- 7. Building and Managing Docker Images using Dockefile.
- 8. Develop and run a Simple Containerized Application using Docker.
- 9. Installation and Configuration of Jenkins; Creating a Basic Freestyle Job.
- 10. Creating a Simple Declarative Pipeline for Continuous Integration using Jenkins.

Text Books:

1. LINUX POCKET GUIDE: ESSENTIAL COMMANDS by DANIEL J. BARRETT, O'REILLY

References:

1. DEVOPS: A SOFTWARE ARCHITECT'S PERSPECTIVE (SEI SERIES IN SOFTWARE ENGINEERING) by LEN BASS , INGO WEBER, LIMING ZHU, ADDISON-WESLEY

2. KUBERNETES ESSENTIALS: A PRACTICAL GUIDE TO CONTAINER ORCHESTRATION by ROBERT FRANGIAS, ATLANTIC PUBLISHERS