K L Deemed to be University

Department of Computer Science and Information Technology -- KLVZA
Course Handout
2025-2026, Even Sem

Course Title	**: FOUNDATIONS OF CLOUD-NATIVE COMPUTING & DEVOPS**
Course Code	**: 24CS2260F**
L-T-P-S Structure	**: 2-0-2-0**
Pre-requisite	:
Credits	**: 3**
Course Coordinator	**: Lavanya Susanna Choutupalli**
Team of Instructors	:
Teaching Associates	:
Syllabus :	CO1:Cloud models (IaaS, PaaS, SaaS) and deployment models (public/private/hybrid); microservices vs monoliths (domain boundaries, coupling, deployment blast radius); Docker: engine, images & layers, Dockerfiles (multi-stage builds), tagging/versioning; volumes, container networking (bridge/host), Docker Compose for local multi-service dev; image hygiene (small base images, CVE awareness); intro to registries (Docker Hub/GitHub Container Registry). CO2:K8s architecture (API server, scheduler, controller manager, etcd); core objects: Pod, ReplicaSet, Deployment, Service; service discovery & DNS; probes (liveness/readiness/startup); requests/limits; basic HPA (metrics-server); namespacing and RBAC (intro); kubectl workflows (apply/rollout/logs/port-forward); local clusters with kind/minikube; config management: ConfigMaps & Secrets. CO3:Git branching strategy, PR checks; unit & container build stages; image scanning (intro) and SBOM awareness; pushing to registry; templated pipelines (GitHub Actions/Jenkins freestyle vs pipeline); caching for faster builds; minimal test pyramid (unit > integration smoke). CO4:IAM & secret handling (K8s Secrets, sealed-secrets overview); basic policy (admission controllers high-level); lightweight observability: kubectl logs, container logs, node metrics; basic alert ideas (crashloopbackoff detection); rollout & rollback hygiene; cost-awareness for small clusters; documenting decisions with ADRs (short form).
Text Books :	1.Cloud Native DevOps with Kubernetes(O'Reilly) 2.The DevOps Handbook (Gene Kim) 3.Kubernetes Up & Running (O'Reilly) 4.Docker Deep Dive (Nigel Poulton)
Reference Books :	1.Kubernetes: Up & Running (3e) -Kelsey Hightower, Brendan Burns, Joe Beda,O'Reilly Media 2.The Kubernetes book-Nigel poulton& puskar joglekar 3.Cloud Native Patterns-Cornelia Davis,Manning Publications 4.Cloud Native Infrastructure-Justin Garrison, Kris Nova,O'Reilly Media
Web Links :	1.https://learn.microsoft.com/en-us/dotnet/architecture/cloud-native/ 2.https://learn.microsoft.com/en-us/devops/ 3.https://www.jenkins.io/doc/ 4.https://docs.gitlab.com/ci/
MOOCS :	1https://www.coursera.org/learn/docker-basics-for-devops. 2.https://www.coursera.org/learn/kubernetes-for-absolute-beginners 3.https://www.coursera.org/projects/build-a-cicd-pipeline-with-docker-from-code-to-deployment

Course Rationale :	This course teaches cloud-native app development using Docker and Kubernetes, covering containerization, microservices, and cloud models (IaaS, PaaS, SaaS). Students will learn Kubernetes architecture, core components, and scaling, along with CI/CD practices, Git workflows, and pipeline automation. The course also addresses security, observability, and cost management for cloud apps, preparing students to deploy and manage scalable, secure applications.
Course Objectives :	1.Learn to build and manage containerized services with Docker, while understanding the trade-offs between microservices and monolithic architectures. 2.Gain hands-on experience deploying and managing applications on Kubernetes, including Pods, Deployments, Services, health probes, and autoscaling. 3.Design efficient CI/CD pipelines using GitHub Actions or Jenkins, optimizing stages for builds, tests, scans, and image publishing. 4.Design a minimal production path, integrating containers, Kubernetes, and CI/CD, with a focus on IAM, secrets, config management, and observability.

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Build containerized services with Docker (images, layers, volumes, basic networking) and contrast microservices vs. monolith trade-offs in a given scenario.	PO1,PO2,PSO1	3
CO2	Deploy and manage workloads on Kubernetes (pods, deployments, services) with health probes and autoscaling for a small multi-service app.	PO2,PO3,PSO1	3
CO3	Analyze the stages of a CI pipeline using GitHub Actions or Jenkins to determine how builds, tests, scans, and image publishing should be structured for efficient container delivery	PO3,PO5,PSO1	4
CO4	Analyze and design a minimal production path (container → K8s → CI) including IAM/secrets, config management, and lightweight observability and justify decisions ,trade-offs.	PO3,PO5,PSO2	4
CO5	Analyze and construct containerized applications, deploy them on Kubernetes, evaluate the stages of a basic CI pipeline, and formulate a minimal production-ready workflow incorporating secure configuration, secrets management, and observability	PO3,PO5,PSO2	4

COURSE OUTCOME INDICATORS (COIs)::

Outcome No.	Highest BTL	COI-2	COI-3	COI-4
CO1	3	**Btl-2** Demonstrate Docker image structure, layers, volumes, and basic networking concepts	**Btl-3** Apply Docker commands and configurations to containerize simple applications.	

Outcome No.	Highest BTL	COI-2	COI-3	COI-4
CO2	3	**Btl-2** Illustrate Kubernetes core objects such as pods, deployments, services, probes, and autoscaling principles.	**Btl-3** Apply Kubernetes workload management concepts to interpret deployment behaviours in multi-service applications.	
CO3	4	**Btl-2** Interpret the purpose and flow of CI pipeline stages including build, test, scan, and image publishing.	**Btl-3** Apply Continuous Integration (CI) concepts to interpret how pipeline steps automate container delivery workflows.	**Btl-4** Analyze Continuous Integration (CI) pipeline configurations to determine inefficiencies and opportunities for improvement
CO4	4	**Btl-2** Explain the components of a production-ready container deployment path including IAM, secrets, and observability tools.	**Btl-3** Apply production concepts to propose basic configurations for secrets, config management, and monitoring.	**Btl-4** Analyze architectural decisions and trade-offs when designing a minimal production workflow.
CO5	4	**Btl-2** Outline the relationships among containerization, Kubernetes deployment, CI stages, and production workflow requirements.	**Btl-3** Apply containerization and CI/CD concepts to build and deploy multi-service applications.	**Btl-4** Analyze the security, configuration, and observability requirements of production-ready deployments.

PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES (POs/PSOs)

Po No.	Program Outcome
PO1	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO5	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PSO1	To develop expertise in tool-based solutions, applying theoretical knowledge to industry-driven challenges in software development, data analytics, and emerging technologies.
PSO2	To foster innovation through research-driven problem-solving while upholding ethical and responsible computing practices to address IT challenges.

Lecture Course DELIVERY Plan:

Sess.No.	CO	COI	Topic	Book No[CH No] [Page No]	Teaching-Learning Methods	EvaluationComponents
1	CO1	COI-2	Introduction to Cloud and Cloud-Native Computing	9,T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
2	CO1	COI-2	Cloud Deployment Models: Public, Private, Hybrid	10,T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
3	CO1	COI-2	Microservices vs Monoliths: Key Differences	15,T1	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
4	CO1	COI-2	Deployment Blast Radius & Scalability in Microservices	20,T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
5	CO1	COI-3	Introduction to Docker: Engine, Images, and Layers	117,T4	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
6	CO1	COI-3	Writing Dockerfiles & Multi-Stage Builds	135,T4	Chalk,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM1
7	CO1	COI-3	Docker Volumes & Networking	39,T4	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
8	CO1	COI-3	Docker Compose and Image Hygiene:	132,T4	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
9	CO2	COI-3	Introduction to Kubernetes Architecture	3,R2	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
10	CO2	COI-3	Core K8s Objects: Pods, ReplicaSets, Deployments	19,R2	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
11	CO2	COI-3	Kubernetes Services and Service Discovery (DNS)	16,R2	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
12	CO2	COI-3	Kubernetes Probes (Liveness, Readiness, Startup)	60,R1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
13	CO2	COI-3	Resource Requests and Limits, Horizontal Pod Autoscaler (HPA)	66,R1	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1

Sess.No.	CO	COI	Topic	Book No[CH No] [Page No]	Teaching-Learning Methods	EvaluationComponents
14	CO2	COI-3	Namespaces, RBAC, and kubectl Workflow	70,R1	Chalk,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM1
15	CO3	COI-3	Git Workflow for Cloud-Native Development	75,T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
16	CO3	COI-3	Unit & Container Build Stages	80,T4	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM2
17	CO3	COI-3	Image Scanning, SBOM Awareness, and Pushing to Registries	86,T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
18	CO3	COI-3	CI/CD Pipelines	90,T1	Chalk,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM2
19	CO3	COI-3	Caching for Faster Builds and Image Versioning	94,T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
20	CO3	COI-4	Minimal Test Pyramid	98,T3	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM2
21	CO4	COI-3	IAM & Secret Management in Kubernetes	100,T3	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
22	CO4	COI-4	Basic Policy Management	105,T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
23	CO4	COI-3	Basic Observability: kubectl Logs, Container Logs, Node Metrics	110,T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
24	CO4	COI-4	CrashLoopBackOff Detection and Basic Alerting	112,T1	Chalk,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM2
25	CO4	COI-3	Rollout & Rollback Hygiene in Kubernetes	120,T1	Chalk,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2

Sess.No.	CO	COI	Topic	Book No[CH No] [Page No]	Teaching-Learning Methods	EvaluationComponents
26	CO4	COI-4	Documenting Decisions with ADRs	126,T1	Chalk,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM2

Lecture Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Understand Cloud Models and Deployment Strategies

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Handout Explanation	2	PPT	--- NOT APPLICABLE ---
20	Demonstrate Importance of Cloud-Native & Cloud Models	2	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 Understand Cloud Models and Deployment Strategies

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Explanation of Public Cloud, Private Cloud, and Hybrid Cloud	2	PPT	--- NOT APPLICABLE ---
20	: Real-world examples of companies using each deployment model	2	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
				---

SESSION NUMBER : 3

Session Outcome: 2 Compare and Contrast Microservices vs Monolithic Architectures

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Explanation of Microservices and Monolithic Architecture	2	PPT	Case Study
20	Key differences: Domain Boundaries, Coupling,	2	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 4

Session Outcome: 2 Compare and Contrast Microservices vs Monolithic Architectures

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Explain Deployment Blast Radius and how microservices help reduce it	2	PPT	--- NOT APPLICABLE ---
20	Discuss scalability in microservices.	2	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 5

Session Outcome: 3 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Introduction to Docker Engine, Docker Images, and how images are built	2	PPT	--- NOT APPLICABLE ---
20	Build a simple Docker image & Run the Docker containers	3	PPT	Shadowing
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 6

Session Outcome: 3 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Dockerfile basics: Commands like FROM, RUN, COPY, etc.	3	PPT	--- NOT APPLICABLE ---
20	Develop a Dockerfile with a multi-stage build	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 7

Session Outcome: 3 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Apply Volumes: Persistent data storage used by containers.	3	PPT	--- NOT APPLICABLE ---
20	Apply Docker Networking (Bridge/Host) and basic concepts of Docker Registries.	3	PPT	--- NOT APPLICABLE

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
				---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 8

Session Outcome: 3 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Orchestrate multi-container applications locally	3	PPT	--- NOT APPLICABLE ---
20	Make use of small base images, CVE awareness	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 9

Session Outcome: 4 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Explain the components of Kubernetes Architecture	2	PPT	--- NOT APPLICABLE ---
20	Make use of kubectl to interact with the Kubernetes API.	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 10

Session Outcome: 4 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Illustrate Pods, ReplicaSets, and Deployments in Kubernetes.	2	PPT	Puzzle, Enigma, Contradiction
20	Create a simple Pod, scale it to a ReplicaSet, and update it using Deployment	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 11

Session Outcome: 4 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Overview of Kubernetes Services: ClusterIP, NodePort, LoadBalancer	2	PPT	--- NOT APPLICABLE ---
20	Expose a service using kubectl expose and test it	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 12

Session Outcome: 4 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Explain Liveness Probes, Readiness Probes, and Startup Probes in Kubernetes.	2	PPT	--- NOT APPLICABLE

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
				---
20	Add liveness and readiness probes to a Kubernetes Deployment and check their behavior.	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 13

Session Outcome: 4 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Demonstrate Resource Requests and Limits and Horizontal Pod Autoscaler (HPA).	2	PPT	--- NOT APPLICABLE ---
20	Set up resource request and Create a basic Horizontal Pod Autoscaler based on CPU usage	3	PPT	Statement-Opinion-Summary
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 14

Session Outcome: 4 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Illustrate Namespaces and RBAC (Role-Based Access Control) in Kubernetes	2	PPT	--- NOT APPLICABLE ---
20	Set up a new namespace in Kubernetes and define an RBAC role for it.o Use kubectl to interact with the cluster.	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 15

Session Outcome: 5 Implement Efficient CI/CD Pipelines

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Develop a strategy for managing multiple branches in Git (e.g., feature branches, master/main).	3	PPT	--- NOT APPLICABLE ---
20	Build a sample Git workflow (branching, committing, opening PRs)	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 16

Session Outcome: 5 Implement Efficient CI/CD Pipelines

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Discuss the unit testing phase of CI/CD and the container build process	2	PPT	--- NOT APPLICABLE ---
20	Set up a basic unit test for a containerized app and run it through a pipeline.	3	PPT	Think / Pair / Share
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 17

Session Outcome: 5 Implement Efficient CI/CD Pipelines

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
20	Overview of Image Scanning for vulnerabilities, SBOM	2	PPT	--- NOT APPLICABLE ---
20	Use a tool like Trivy or Clair to scan a Docker image for vulnerabilities and push the image	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 18

Session Outcome: 5 Implement Efficient CI/CD Pipelines

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Introduction to CI/CD Pipelines with GitHub Actions	2	PPT	--- NOT APPLICABLE ---
20	Create a simple pipeline with GitHub Actions or Jenkins	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 19

Session Outcome: 5 Implement Efficient CI/CD Pipelines

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Explain caching strategies for speeding up builds and image versioning techniques.	2	PPT	--- NOT APPLICABLE ---
20	Implement caching in a Docker build and show how to tag images for version control.	3	PPT	--- NOT APPLICABLE ---

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 20

Session Outcome: 5 Implement Efficient CI/CD Pipelines

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Implement a a basic test for unit, integration, and smoke levels.	3	PPT	--- NOT APPLICABLE ---
20	Analyze the prioritization of test typeS to ensure fast and reliable early feedback in CI/CD pipelines.	4	PPT	Quiz/Test Questions
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 21

Session Outcome: 6 Apply Container Security Practices

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Illustrate IAM (Identity and Access Management) and secret management in Kubernetes	2	PPT	--- NOT APPLICABLE ---
20	Create and manage secrets in Kubernetes	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 22

Session Outcome: 6 Apply Container Security Practices

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Overview of Admission Controllers in Kubernetes, their role in enforcing policies	2	PPT	--- NOT APPLICABLE ---
20	Analyze how Kubernetes enforces security and validation when creating or modifying resources	4	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 23

Session Outcome: 7 Troubleshoot and Monitor Kubernetes Applications

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Introduction to observability: logs, metrics, and tracing in Kubernetes	2	PPT	--- NOT APPLICABLE ---
20	Use kubectl logs to fetch logs and explore node metrics	3	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 24

Session Outcome: 7 Troubleshoot and Monitor Kubernetes Applications

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Identify if a pod is repeatedly crashing and help in debugging.	2	PPT	--- NOT APPLICABLE ---

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
20	Analyze how to detect and debug a pod that is repeatedly crashing.	4	PPT	--- NOT APPLICABLE ---
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 25

Session Outcome: 8 Ensure Rollback and Rollout Hygiene in Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Demonstrate the importance of rollout and rollback processes for stability and availability.	2	PPT	--- NOT APPLICABLE ---
20	Perform a rollout and rollback operation on a Kubernetes Deployment.	3	PPT	Problem-Based Learning
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 26

Session Outcome: 9 Document Architectural Decisions and Best Practices

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Introduction to Architectural Decision Records (ADRs)	2	PPT	--- NOT APPLICABLE ---
20	Analyze simple ADR for a cloud-native application architecture.	3	PPT	Quiz/Test Questions
5	Recap key points	1	Talk	--- NOT APPLICABLE ---

Tutorial Course DELIVERY Plan:

NO Delivery Plan Exists

Tutorial Session wise Teaching – Learning Plan

No Session Plans Exists

Practical Course DELIVERY Plan:

Tutorial Session no	Topics	CO-Mapping
1	Explore Docker Hub and experiment with using pre-built Docker images.	CO5
2	Working with Dockerfile with a multi-stage build , Docker Networking,and Volumes	CO5
3	Create and run a multi-service application using Docker Compose	CO5
4	Containerize a CRUD microservice by creating a Docker container for it, ensuring that it can run independently with all necessary dependencies	CO5
5	Create a Docker Compose setup that launches both your application and a PostgreSQL database locally	CO5
6	Working with Kubernetes to deploy and manage applications	CO5
7	Deploy the application and PostgreSQL database on Kubernetes.	CO5
8	Set readiness/liveness probes and enable HPA in a Kubernetes Deployment.	CO5
9	Deploy to GitHub via Git	CO5
10	Working with CI Pipeline: Build & Test	CO5
11	Push images with version tags and generate SBOM.	CO5
12	Create and manage secrets in Kubernetes	CO5
13	Working with Rollout & Rollback Hygiene in Kubernetes	CO5

Practical Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Install Docker, Docker Desktop and Creating an Account in Docker Hub:	2	PPT	--- NOT APPLICABLE ---
40	Browse Docker Hub for appropriate images to host a website	3	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Build a personalized container image for your application using a custom Dockerfile	3	PPT	--- NOT APPLICABLE ---
40	Create a Docker network and volumes	3	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 3

Session Outcome: 1 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Working with docker compose	3	PPT	--- NOT APPLICABLE ---

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
40	Set up and run three tier web application	3	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 4

Session Outcome: 1 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Containerize a simple RESTful CRUD app	3	PPT	--- NOT APPLICABLE ---
40	Run the RESTful CRUD app container, and verify the functionality of the application	3	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 5

Session Outcome: 1 Master Containerization with Docker

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Design a Compose file that orchestrates your app and a PostgreSQL container	3	PPT	--- NOT APPLICABLE ---
40	Steps for Docker Compose configuration ensure that your application reliably connects to the PostgreSQL database	3	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 6

Session Outcome: 2 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Set up a basic Kubernetes environment consisting of one control-plane (master) node and two worker nodes.	3	PPT	--- NOT APPLICABLE ---
40	Deploy a simple Nginx application in a new namespace and expose it using a Service in Kubernete	3	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 7

Session Outcome: 2 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Create a Docker Compose file with two services: one for a PostgreSQL database and another for your application	3	PPT	--- NOT APPLICABLE ---
40	Health check configuration to ensures the app connects	4	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 8

Session Outcome: 3 Configure and Scale Kubernetes Applications

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
40	Add liveness and readiness probes to a Kubernetes Deployment and check their behavior	3	PPT	--- NOT APPLICABLE ---
40	Analyze their impact on stability and scalability	4	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 9

Session Outcome: 4 working with Git workflow

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Use Git commands to set up your GitHub account, install Git, and push all files from a local repository to GitHub	3	PPT	--- NOT APPLICABLE ---
40	Create a sample Git workflow (branching, committing, opening PRs) for cloud-native apps	3	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 10

Session Outcome: 5 Implement Efficient CI/CD Pipelines

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Create a GitHub Actions (or Jenkins) pipeline to automate checkout	3	PPT	--- NOT APPLICABLE ---
40	Create pipeline to unit tests, and Docker image build	3	PPT	--- NOT APPLICABLE ---

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 11

Session Outcome: 6 Apply Container Security Practices

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Login to GHCR/Docker Hub, tag your Docker image with semantic versions,	3	PPT	--- NOT APPLICABLE ---
40	Generate an SBOM (using Syft or built-in tools) as an artifact	3	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 12

Session Outcome: 2 Deploy and Manage Applications on Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Encrypt one secret and demonstrate how it is stored securely	3	PPT	--- NOT APPLICABLE ---
40	Analyze the process and tools used to manage and decrypt the secret when needed	4	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 13

Session Outcome: 7 Ensure Rollback and Rollout Hygiene in Kubernetes

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
10	Attendance	1	Talk	--- NOT APPLICABLE ---
40	Perform a rollout and rollback operation on a Kubernetes Deployment	3	PPT	--- NOT APPLICABLE ---
40	Analyze how rollouts and rollbacks are performed in a Kubernetes Deployment,	4	PPT	--- NOT APPLICABLE ---
10	Viva	1	Talk	--- NOT APPLICABLE ---

Skilling Course DELIVERY Plan:
NO Delivery Plan Exists

Skilling Session wise Teaching – Learning Plan

No Session Plans Exists

WEEKLY HOMEWORK ASSIGNMENTS/ PROBLEM SETS/OPEN ENDEDED PROBLEM-SOLVING EXERCISES etc:

Week	Assignment Type	Assignment No	Topic	Details	co
3	Weekly Homework Assignments	1	Cloud deployment models & a multi-stage Dockerfile	1.Apply cloud deployment models by taking a real application (e.g., an e-commerce site) and classifying which components you would deploy on public, private, and hybrid cloud models, justifying your placement for each. 2.Build and run a multi-stage Dockerfile for any simple application (Node/Java/Python), apply tagging/versioning, and demonstrate how Docker Compose can run it with a database.	CO1
7	Weekly Homework Assignments	2	Kubernetes Core Concepts	1.Apply Kubernetes resource definitions by creating a Deployment + Service for any microservice and	CO2

Week	Assignment Type	Assignment No	Topic	Details	co
				configure liveness & readiness probes based on how the service behaves. 2.Use resource limits and HPA by deploying a sample workload and configuring requests/limits and a basic HPA, then explain how HPA reacts when you generate load using kubectl or a curl loop.	
9	Weekly Homework Assignments	3	CI/CD, GitOps, DevSecOps	1.Apply a Git branching strategy by simulating a real feature workflow: Create a feature branch → make commits → open PR → add PR checks (lint/unit test) → merge. Submit screenshots + explanation of workflow. 2.Implement a minimal CI pipeline that builds a container, runs a unit test, performs an image scan (Trivy), and pushes a tagged image to a registry. Submit GitHub Actions/Jenkins YAML + output screenshots.	CO3
12	Weekly Homework Assignments	4	Security, Observability, Rollouts, ADRs	1.Apply secret-management concepts by creating a Kubernetes Secret for an app, then convert it into a Sealed-Secret and demonstrate how it is safely committed/pushed to Git. 2.Use Kubernetes observability tools by deploying an app and intentionally causing a CrashLoopBackOff, then capturing: • pod logs • describe output • fix + rollout the working version	CO4

COURSE TIME TABLE:

	Hour	1	2	3	4	5	6	7	8	9
Day	Component									
Mon	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--

	Hour	1	2	3	4	5	6	7	8	9
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--
Tue	Theory	---	---	---	---	V-S1,V-S2,V-S51	V-S1,V-S2,V-S51	---	---	---
	Tutorial	---	---	---	---	--	--	---	---	---
	Lab	---	---	---	---	V-S3,V-S3,V-S3	V-S3,V-S3,V-S3	---	---	---
	Skilling	---	---	---	---	--	--	---	---	---
Wed	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--
Thu	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--
Fri	Theory	---	---	V-S3	V-S3	---	---	---	---	---
	Tutorial	---	---	--	--	---	---	---	---	---
	Lab	---	---	V-S1,V-S1,V-S1,V-S2,V-S2,V-S2,V-S51,V-S51,V-S51	V-S1,V-S1,V-S1,V-S2,V-S2,V-S2,V-S51,V-S51,V-S51	---	---	---	---	---
	Skilling	---	---	--	--	---	---	---	---	---
Sat	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--
Sun	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--

REMEDIAL CLASSES:

Supplement course handout, which may perhaps include special lectures and discussions that would be planned, and schedule notified according

SELF-LEARNING:

Assignments to promote self-learning, survey of contents from multiple sources.

S.no	Topics	CO	ALM	References/MOOCS

DELIVERY DETAILS OF CONTENT BEYOND SYLLABUS:

Content beyond syllabus covered (if any) should be delivered to all students that would be planned, and schedule notified accordingly.

S.no	Advanced Topics, Additional Reading, Research papers and any	CO	ALM	References/MOOCS

EVALUATION PLAN:

Evaluation Type	Evaluation Component	Weightage/Marks		Assessment Dates	Duration (Hours)	CO1	CO2	CO3	CO4	CO5
End Semester Summative Evaluation Total= 40 %	Lab End Semester Exam	Weightage	16		120					16
		Max Marks	50							50
	End Semester Exam	Weightage	24		180	6	6	6	6	
		Max Marks	100			25	25	25	25	
In Semester Formative Evaluation Total= 24 %	Continuous Evaluation - Lab Exercise	Weightage	10		120					10
		Max Marks	50							50
	Home Assignment and Textbook	Weightage	6		100	1.5	1.5	1.5	1.5	
		Max Marks	40			10	10	10	10	
	ALM	Weightage	8		100	2	2	2	2	
		Max Marks	60			15	15	15	15	
In Semester Summative Evaluation Total= 36 %	Lab In Semester Exam	Weightage	8		120					8
		Max Marks	50							50
	Semester in Exam-II	Weightage	14		90			7	7	
		Max Marks	50					25	25	
	Semester in Exam-I	Weightage	14		90	7	7			
		Max Marks	50			25	25			

ATTENDANCE POLICY:

Every student is expected to be responsible for regularity of his/her attendance in class rooms and laboratories, to appear in scheduled tests and examinations and fulfill all other tasks assigned to him/her in every course
In every course, student has to maintain a minimum of 85% attendance to be eligible for appearing in Semester end examination of the course, for cases of medical issues and other unavoidable circumstances the students will be condoned if their attendance is between 75% to 85% in every course, subjected to submission of medical certificates, medical case file and other needful documental proof to the concerned departments

DETENTION POLICY :

In any course, a student has to maintain a minimum of 85% attendance and In-Semester Examinations to be eligible for appearing to the Semester End Examination, failing to fulfill these conditions will deem such student to have been detained in that course.

PLAGIARISM POLICY :

Supplement course handout, which may perhaps include special lectures and discussions

COURSE TEAM MEMBERS, CHAMBER CONSULTATION HOURS AND CHAMBER VENUE DETAILS:

Supplement course handout, which may perhaps include special lectures and discussions

Name of Faculty	Delivery Component of Faculty	Sections of Faculty	Chamber Consultation Day (s)	Chamber Consultation Timings for each day	Chamber Consultation Room No:	Signature of Course faculty:
S N Lakshmi Malluvalasa	P	2-C	-	-	-	-
Mounika Valasapalli	P	51-B	-	-	-	-
Ravi Teja Kanakala	P	2-B	-	-	-	-
Surya Sasank Visamsetty	L	1-MA	-	-	-	-
Surya Sasank Visamsetty	P	1-A	-	-	-	-
Cherukupalli Sowjanya	P	1-C	-	-	-	-
Sai Durga Vinnakota	P	3-C	-	-	-	-
Dineshnath Gopinath	P	51-C	-	-	-	-
NATHA PRIYA	P	1-B	-	-	-	-
Selvamuthukumar T	P	3-B	-	-	-	-
Lavanya Choutupalli	L	2-MA	-	-	-	-
Lavanya Choutupalli	P	2-A	-	-	-	-
Sathyavani Addanki	L	3-MA	-	-	-	-
Sathyavani Addanki	P	3-A	-	-	-	-
Muni Nagamani G	L	51-MA	-	-	-	-
Muni Nagamani G	P	51-A	-	-	-	-

GENERAL INSTRUCTIONS

Students should come prepared for classes and carry the text book(s) or material(s) as prescribed by the Course Faculty to the class.

NOTICES

Most of the notices are available on the LMS platform.

All notices will be communicated through the institution email.

All notices concerning the course will be displayed on the respective Notice Boards.

Signature of COURSE COORDINATOR

(Lavanya Susanna Choutupalli)(8932)(CS&IT)

Signature of Department Prof. Incharge Academics & Vetting Team Member

Department Of EL&GE

HEAD OF DEPARTMENT:

Approval from: DEAN-ACADEMICS
(Sign with Office Seal)
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