COURSE DESCRIPTION FORM: CS-4033 DEVOPS AND CLOUDNATIVE

INSTITUTION   FAST School of Computing, National University of Computer and Emerging Sciences, Islamabad

BS-CS: Fall-2021

PROGRAMS TO BE EVALUATED

Course Description

Course Code	CS-4033
Course Title	DevOps and Cloud Native
Credit Hours	3
Prerequisites by Course(s) and Topics	Database Systems, Data Structures, Operating Systems, Web Development
Grading Policy	Absolute grading
Policy about missed assessment items in the course	Retake of missed assessment items (other than midterm/ final exam) will not be held. For a missed midterm/ final exam, an exam retake/ pretake application along with necessary evidence are required to be submitted to the department secretary. The examination assessment and retake committee decides the exam retake/ pretake cases.
Course Plagiarism Policy	Plagiarism in project or midterm/ final exam may result in F grade in the course. Plagiarism in an assignment will result in zero marks in the whole assignments category.

Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)

75% Theory and 25% practical

Assessment Item	Number	Weight (%)
Blog Writing + Mid 1	1 + 1	30%
Blog Writing + Mid 2	1 + 1	30%
Final + Blog Writing	1 + 1	30%
Open Source Contribution	1	10

Course Instructors	Muhammad Saim Safdar
Lab Instructors (if any)	
Course Coordinator	Muhammad Saim Safdar
URL (if any)	
Current Catalog Description	DevOps culture has taken over the software industry and permanently changed the way many organizations do their work. DevOps is a culture of collaboration between Development and Operations teams that is supported by a variety of practices and tools. Through practices such as monitoring, CI/CD, and blameless retrospectives we

	can reliably deliver software with great speed and high-quality. In this course, you will learn about this culture, these practices, and more!
Textbook (or **Laboratory Manual** for Laboratory Courses)	Nigel Poulton, **The Kubernetes Book**, 2022 Edition. Nigel Poulton, **Docker Deep Dive, 2022 Edition**
Reference Material	1. **The DevOps Hand Book** – How to Create World-Class Agility, Reliability, Gene Kim, Patrick Debois, John Willis, Jez Humble, John Allspaw. 2.
Course Learning Outcomes	(see below)

A. Course Learning Outcomes (CLOs)

This course addresses the concepts, core concepts in the cloud computing, orchestration technologies such as kubernetes, container technologies such as docker, buildah, podman and kaniko, kubernetes certification guide CKA, CKAD, CKS and KCNA and managed Kubernetes such as AKS, EKS and GKE.

1. The steps that changes to software go through to get from a developer's computer to its users.
2. The role and responsibilities of a traditional Operations team.
3. An overview of modern infrastructure management.
4. The difference between a DevOps culture and that of a traditional organization.
5. Kubernetes is going to stay for a longer run and industry skill shortage is huge and this course structured in a way to help students build the core knowledge of kubernetes industry is looking for.

B. Program Learning Outcomes

1. Computing Knowledge	Apply knowledge of mathematics, natural sciences, computing fundamentals, and a computing specialization to the solution of complex computing problems.	✔
2. Problem Analysis	Identify, formulate, research literature, and analyze complex computing problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and computing sciences.	✔
3. Design/ Develop Solutions	Design solutions for complex computing problems and design systems, components, and processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.	✔

4. Investigation & Experimentation	Conduct investigation of complex computing problems using research based knowledge and research based methods.	
5. Modern Tool Usage	Create, select, and apply appropriate techniques, resources and modern computing tools, including prediction and modelling for complex computing problems.	✔
6. Society Responsibility	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues relevant to context of complex computing problems.	
7. Environment and Sustainability	Understand and evaluate sustainability and impact of professional computing work in the solution of complex computing problems.	
8. Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of computing practice.	
9. Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	✔
10. Communication	Communicate effectively on complex computing activities with the computing community and with society at large.	
11. Project Management and Finance	Demonstrate knowledge and understanding of management principles and economic decision making and apply these to one's own work as a member or a team.	
12. Life Long Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.	

C.   Mapping of CLOs on PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

	PLOs											
	1	2	3	4	5	6	7	8	9	10	11	12

	CLOs													
		1	☐			☐								
		2	☐			☐								
		3	☐	☐	☐				☐					
		4	☐	☐	☐				☐					
		5	☐	☐		☐								

Topics covered in the course with number of lectures on each topic (assume 15 weeks of instruction and 1.5 hour lecture duration)	Topics	Lectures
	Introduction to DevOps, Git and GitHub	1
	Docker	3
	Kubernetes	10
	Cloud and Security in the cloud	4
	Open Source Contribution	4
	GitOps	2
	Site Reliability Engineering	2
	Developer Relationship	2
	Policy Enginer and Compliance in K8s	2
	Total	30

Laboratory Projects/Experiments Done in the Course	
Programming Assignments Done in the Course	Programming assignments are related to blog writing, online Lab exercises and real world production apps.

Class Time Spent per Week (in percentage)	Thoery (%)	Hands On (%)	Communication skills (%)	Speaking skills (%)
	20	50	20	10

Oral and Written Communications	Every student is required to submit at least __1___ blog on medium during mid and mid2

COURSE CONTENTS

Weeks	Contents/ Topics	Courseware Events (Lab/ Case Study/ Quiz/ Assignment/ Project/ Presentation/ Research Report/ Term Paper etc.)	Comments (if any)
Week-01	● Practical Intro of Git, GitHub, DevOps Roadmap 2022 and trrue meanings of Contributing to Open source ● CNCF Landscape virtual tour	Lab exercise	
Week-02	● Brief History of virtualization, ● Docker and containers Fundamentals	Lab exercise	
Week-03	● Docker architecture and networking ● Beginner friendly intro of Open Container Initiative	Blog writing	
Week-04	● Exloping the docker alternative for building container images (Buildah, Podman, Kaniko, ko) ● How to sign container images with Cosign	Blog writing	
Week-05	● Exploring the Orchestration world ● Beginner friendly dive into Kubernetes	Blog writing	
Week-06	● Kubernetes Core Concepts ● Kubernetes Architecture & running K8S locally with (K3S, K0S and minikube)	Lab exercise	
Week-07	● Building and deploying microservices apps on Kubernetes. ● Kubernetes Ingress controller (Traefik, nginx, HA proxy)	Lab exercise	
Week-08	● Kubernetes Policy Engines (Kyverno and Open Ploicy Agent)	Blog writing	
Week-09	● Students Q&A's ● Intro of Service Mesh world	Mid Exam	
Week-10	● Linkerd and side-care containers Deep Dive ● Understanding Service Mesh eco-system	Lab exercise	
Week-11	● Introduction to GitOps ● GitOps enabled CICD with argocd and flux	Lab exercise	
Week-12	● Practical deep dive into container security. ● Best practices for Kubernetes Security	Blog writing	
Week-13	● Introduction to manage k8s offering (AKS, EKS and GKE)	Blog writing	
Week-14	● Cloud-native maturity model ● Tips and tricks for getting a DevOps and Kubernetes job	Blog writing	
Week-15	● DevOps, Open Source and K8s contribution practical deep dive	Project submission + Contribution to Open Source	
Week-16	● Students Q & A's	Project Demo's and evaluations	