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**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, Dec 2023**

Course:  Container Orchestration and Infrastructure Automation          Semester:  V
Program:   B.Tech CS-CCVT                                                                        Time: 03 hrs.
Course Code: CSVT3009                                                                             Max. Marks: 100

**Instructions: Attempt all the Questions. Choices are mentioned internally**

| Section A | | | |
|---|---|---|---|
| **S. No.** | | **Marks** | **CO** |
| **Q 1** | Compare the isolation mechanisms in virtualization and containerization. Discuss how the level of isolation impacts security and resource efficiency in each approach. | **4** | **CO1** |
| **Q 2** | Match the following:<br><table><tr><td>a)  Hub</td><td>a)  Network</td></tr><tr><td>b)  Swarm</td><td>b)  Container Engine</td></tr><tr><td>c)  Overlay</td><td>c)  Orchestration</td></tr><tr><td>d)  Podman</td><td>d)  Registry</td></tr></table> | **4** | **CO1** |
| **Q 3** | How Dockerfile contributes to the reproducibility of environments in containerization process. | **4** | **CO2** |
| **Q 4** | Compare Docker volumes and bind mounts. Highlight specific scenarios where each approach is preferable in a containerized application. | **4** | **CO2** |
| **Q 5** | Enlist and differentiate different types of Kubectl commands. | **4** | **CO3** |
| Section B | | | |
| **Q 6** | Explain the pivotal components of Docker's architecture, their distinct roles, and how they synergistically collaborate to facilitate the containerization process. | **2+2+6** | **CO1** |
| **Q 7** | You have a basic Java application that you want to run in a Docker container. Outline the key steps to achieve this, covering the following aspects:<br>a. Dockerfile Creation<br>b. Image Building<br>c. Container Execution<br>d. Port Mapping<br>e.  Environment Variable Passing at runtime | **2 X 5** | **CO2** |
| **Q 8** | You are managing a multi-container Docker application, and effective networking is crucial for seamless communication between services. Answer the following:<br>a) Describe the command to create a custom bridge network in Docker.<br>b) Explain how to inspect a Docker network, focusing on retrieving information about connected containers and their IP addresses.<br>c) Outline the steps to connect an existing container to a specific Docker network.<br>e) Explain the concept of Docker's overlay network and provide a scenario where it would be beneficial. | **2+2+2 +4** | **CO2** |

| Q 9 | Outline the key components of a Kubernetes cluster. Explain the roles and responsibilities of these components in the context of orchestrating containerized applications.<br><br>**OR**<br><br>Define Deployment in Kubernetes. Enlist different types of deployments, their advantages and disadvantages. | 10 | CO3 |
|---|---|---|---|
| **Section C** | | | |
| Q 10 | a. Describe the steps involved in initializing a Docker Swarm cluster, including the creation of manager and worker nodes. Highlight any considerations for securing the Swarm cluster.<br>b. Explain how service scaling works in Docker Swarm, providing commands and strategies to scale services both manually and automatically. Discuss potential challenges and mitigation strategies when scaling services. | 10+10 | CO4 |
| Q 11 | As the lead architect of a tech company, you are tasked with optimizing the current application architecture. The team is exploring alternative approaches beyond the existing monolithic setup. In this scenario:<br>  a. Critique the current monolithic architecture, emphasizing specific pain points and challenges. Propose areas for improvement, considering the impact on scalability, agility, and maintenance.<br>  b. Introduce the concept of a Hybrid Architecture, combining aspects of both SOA and Microservices. Outline potential benefits and challenges of this approach, emphasizing how it might strike a balance between the current monolithic system and a complete transition to either SOA or Microservices.<br><br>**OR**<br>As a DevOps engineer overseeing a complex web application's deployment and management, the development team contemplates adopting Docker for enhanced deployment, scalability, and maintainability. Evaluate and offer recommendations on:<br>  a. Identify existing deployment bottlenecks and propose targeted improvements to enhance efficiency.<br>  b. Illuminate the advantages Docker brings, focusing on its impact on portability, isolation, and reproducibility.<br>  c. Assess Docker's role in scalability, addressing orchestration, auto-scaling, and optimizing resource utilization.<br>  d. Investigate Docker's seamless integration with CI/CD, emphasizing enhancements in build processes and deployment speed. | 10+10<br><br>5 X 4 | CO3 |