INTERNATIONAL UNIVERSITY OF EAST AFRICA

'Learning to Succeed'

FACULTY OF SCIENCE AND TECHNOLOGY

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: MIT

YEAR/SEM: YEAR 1/SEMESTER 2

COURSE CODE: MIT723

NAME: VIRTUALIZATION AND CLOUD COMPUTING

DATE: 2025-04-14

TIME: 2:00-5:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully
2. The time allowed for this examination is STRICTLY three hours
3. Read each question carefully before you attempt and allocate your time equally between all the Sections
4. Write clearly and legibly. Illegible handwriting cannot be marked
5. Number the questions you have attempted
6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks
7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A Section A is Compulsory

Question 1:

QUESTION ONE: MERITS OF CLOUD COMPUTING (40 MARKS)

i. What do you understand by the term Cloud Computing. **(02 Marks)**

ii. A rapidly growing e-commerce company experiences a surge in traffic during holiday seasons, causing their on-premise servers to crash. How can cloud computing help businesses scale their infrastructure dynamically to handle fluctuating workloads? **(06 Marks)**

iii. A small startup wants to build an AI-based analytics platform but lacks the capital to invest in expensive hardware and data centers. How does cloud computing help businesses reduce upfront infrastructure costs, and what are the financial benefits of a pay-as-you-go model? **(06 Marks)**

iv. A multinational company has employees working remotely across different time zones and needs a way to collaborate efficiently. How does cloud computing enable seamless remote work and enhance collaboration among distributed teams? **(06 Marks)**

v. An IT manager at a mid-sized company is overwhelmed by the constant need to update security patches and software on their on-premise servers. How does cloud computing simplify software maintenance and security updates for businesses? **(06 Marks)**

vi. A mobile app development company wants to test new features quickly and deploy them without setting up complex infrastructure. How does cloud computing accelerate application development and deployment cycles? **(06 Marks)**

vii. A financial institution is concerned about cybersecurity threats and data breaches. They are considering moving their critical applications to the cloud. How do leading cloud providers enhance security, and what security benefits does cloud computing offer compared to on-premise infrastructure? **(04 Marks)**

viii. A media streaming service wants to expand globally and provide content delivery to users in different countries with minimal latency. How does cloud computing help companies expand their global reach and improve content delivery to end users? **(04 Marks)**

Section B Attempt Any Four Questions from Section B

Question 1:

QUESTION TEN: CLOUD INFRASTRUCTURE (15 MARKS)

i. A financial institution needs a disaster recovery plan to ensure its critical data remains accessible even during a system failure. It uses multiple cloud storage solutions, backup servers, and automated failover mechanisms. What roles do storage devices and cloud management software play in maintaining data integrity and disaster recovery? **(05 Marks)**

ii. A multinational corporation needs centralized cloud storage for its global workforce to store and share documents securely. How do storage devices, cloud management software, and network infrastructure ensure high availability, security, and performance? **(05 Marks)**

iii. A hospital uses a hybrid cloud model to store patient records securely on a private cloud while using a public cloud for analytics and AI-powered diagnostics. What role do servers, storage devices, and platform virtualization play in supporting this hybrid cloud environment? **(05 Marks)**

Question 2:

QUESTION ELEVEN: CLOUD INFRASTRUCTURE (15 MARKS)

i. Private Cloud Data centers share common security threats and vulnerabilities. Distinguish between threats, vulnerabilities. **(04 Marks)**

ii. Private Cloud Data centersâ?? Vulnerabilities can take many forms, provides at least three typical examples of these vulnerabilities, along with the ways in which they could be exploited. **(03 Marks)**

iii. Threats to a Private Cloud Data Center are one of four kinds: interception, interruption, modification, and fabrication. Explain each of these threats, giving examples in each case. **(08 Marks).**

Question 3:

QUESTION ONE: COMPUTE VIRTUALIZATION (15 MARKS)

i. One of your cloud-hosted virtual machines is running on a server that is about to fail. What virtualization strategies can you use to ensure business continuity and minimize service disruption? **(03 Marks)**

ii. A company wants to optimize its IT infrastructure by adopting virtualization. What key differences between full virtualization and para-virtualization should they evaluate before making a decision? **(03 Marks)**

iii. Given a Type-1 hypervisor environment, outline the process of provisioning a new virtual machine while ensuring optimal resource allocation and system stability. **(03 Marks)**

iv. What are the security challenges in a virtualized environment, and how can they be mitigated? **(06 Marks)**

Question 4:

QUESTION NINE: CLOUD COMPUTING ARCHITECTURE (15 MARKS)

i. A retail company is building its e-commerce platform using a microservices architecture in the cloud. Different services handle tasks such as inventory management, payment processing, and user authentication independently. How does a loosely coupled architecture benefit this e-commerce platform? **(05 Marks)**

ii. A startup is developing a serverless web application that processes user uploads using AWS Lambda functions. The front-end application triggers Lambda functions, which process data and store results in a cloud database. How does the loose coupling between cloud components (Lambda, storage, API Gateway) improve scalability and reliability in this scenario? **(05 Marks)**

iii. A company deploys a cloud-based IoT system where smart devices (such as thermostats and security cameras) send data to the cloud, which processes it and sends responses back to users via mobile apps. In this IoT architecture, how does loose coupling between devices, cloud processing units, and databases enhance system performance and resilience? **(05 Marks)**

Question 5:

QUESTION TWELVE: RISKS RELATED TO CLOUD (15 MARKS)

i. A large e-commerce company stores customer data, including credit card information, in the cloud. One day, hackers gain unauthorized access to the cloud storage and steal sensitive customer data. What security measures can be implemented to prevent such breaches? **(05 Marks)**

ii. A financial services company relies on a cloud provider to host its online banking system. Due to an unexpected cloud provider outage, customers cannot access their accounts for several hours. How can businesses mitigate the impact of cloud service outages? **(05 Marks)**

iii. A healthcare organization stores patient records in the cloud but later finds out that the cloud providerâ??s data retention policies do not comply withÂ government regulations. The company struggles to retrieve its data. How can businesses ensure compliance and data control when using cloud services? **(05 Marks)**

Question 6:

QUESTION FOUR: I/O VIRTUALIZATION (15 MARKS)

i. A high-performance network application running in a virtualized environment is experiencing significant I/O delays. How can SR-IOV or paravirtualized I/O improve performance, and what are the key steps to enable these technologies? **(03 Marks)**

ii. You are troubleshooting high latency in virtual disk read/write operations in a virtualized storage setup. What factors could contribute to this issue, and what techniques can be applied to enhance storage I/O performance? **(03 Marks)**

iii. What are the security and isolation challenges associated with I/O virtualization, especially when using direct I/O techniques like PCI passthrough and SR-IOV? What strategies can be used to mitigate these risks? **(03 Marks)**

iv. Examine how I/O virtualization has influenced the scalability and performance of cloud computing. Provide examples of how techniques like SR-IOV and paravirtualized I/O are employed in modern cloud platforms. **(06 Marks)**