JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF COMPUTER SECURITY AND FORENSIC

3RD YEAR 2ND SEMESTER 2024/2025 ACADEMIC YEAR

MAIN CAMPUS

COURSE CODE: ICB 1310

COURSE TITLE: PROGRAMMING DISTRIBUTED COMPONENTS

EXAM VENUE: LAB. 5 : BSC. COMPUTER SECURITY AND FORENSIC

DATE: 22/4/2025 EXAM SESSION: 9.00-11.00

TIME : 2.00 HOURS

INSTRUCTIONS:

1. **Answer Question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on the question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

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Question 1

a) How can intrusion detection systems (IDS) enhance security in distributed systems? 3mks

b) What is data encryption, and why is it important in distributed systems? 2mks

c) How is blockchain technology used in distributed computing give one example where its applied? 2mks

d) What is containerization and why is it important? 2mks

e) What **THREE** ways do distributed systems handle data consistency? 3mks

f) State and explain **THREE** key features of IaaS? 3mks

g) What is the purpose of the MQTT **(Message Queuing Telemetry Transport)** last will and testament (LWT)? 2mks

h) What is the CAP theorem? 3mks

i) Explain four ways how semaphores work in IPC? 2mks

j) What is a race condition, and how do you prevent it? 2mks

k) What is concurrency in computer systems and why is it important? 2mks

l) Explain **FOUR** ways how you can achieve fault tolerance in distributed systems? 4mks

Question 2

a) What are distributed components, state and explain **FOUR** reasons why are they important in distributed systems? 10mks

Answer:

b) Identify and explain giving examples in each case **FIVE** ways how would you program distributed components to handle communication failures? 10mks

Question 3

a) Explain **FIVE** challenges of mitigating DoS attacks in distributed systems, and how they can be addressed? 10mks

b) Identify and explain **FIVE** ways on how would you design a distributed system using blockchain for a decentralized finance (DeFi) application? 10mks

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Question 4

a) Explain **FIVE** ways how would you design a distributed system using serverless computing for a real-time chat application? 10mks
b) How do cloud-native applications differ from traditional monolithic applications in the cloud in terms of **Architecture, Deployment, scalability, resilience and Development speed**? 10mks

Question 5

a) State and describe **FIVE** ways how would you implement a distributed system using RESTful Web Services? 10mks
b) What is Java RMI, Explain **FOUR** key components of a Java RMI application? 10mks

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