The Management University of Africa

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DIPLOMA UNIVERSITY EXAMINATIONS

SCHOOL OF MANAGEMENT AND LEADERSHIP

DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY/ DIPLOMA IN BUSINESS INFORMATION TECHNOLOGY

DIT 201: CONCEPTS OF DATA COMMUNICATION AND NETWORKING

DATE: 9TH APRIL 2026

DURATION: 2 HOURS

MAXIMUM MARKS: 70

INSTRUCTIONS:

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **SIX (6)** questions.
4. Question **ONE** is compulsory.
5. Answer any other **FOUR** questions.
6. Question **ONE** carries 30 MARKS and the rest carry **10 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided.**

QUESTION ONE

Read the Case Study below carefully and answer the questions that follow:

Umoja Energy Ltd is a start-up deploying solar-powered microgrids across rural Kenya. Each microgrid serves households, schools, and local businesses, providing real-time metering and remote monitoring through a smart networked system.

Initially, Umoja relied on cellular data connections and a basic local server at each site. However, data congestion, latency, and high packet loss became major issues as demand increased. Customers complained of delayed usage reports and billing discrepancies.

To resolve these challenges, Umoja hired a networking consultant to redesign their communication infrastructure. The new design included dedicated wireless transmission lines with repeaters, point-to-point microwave links, and a central data warehouse in Nairobi.

The consultant structured the network using a hybrid topology combining star and mesh models to ensure fault tolerance and fast rerouting in case of link failure. Each site now uses routers and switches connected via multiplexed fiber and microwave channels. Network switches manage data packets locally, while routers forward aggregated data to Nairobi's central server.

At the core of the new system is a layered communication architecture. The physical layer uses digital modulation over wireless and fiber links, while the data link layer applies error detection via cyclic redundancy checks. The network layer manages routing tables that update dynamically to account for network congestion. Transport layer services include both TCP for metering logs and UDP for time-sensitive alerts.

With these improvements, Umoja can now support multiple concurrent clients with low latency, and remotely manage faults using SNMP-based tools. The network has scaled across five counties with consistent Quality of Service (QoS) levels.

Required:

a) Identify and explain four major networking problems Umoja experienced with their initial setup. **(4 MARKS)**

b) Describe two ways the consultant improved data transmission efficiency using physical layer and network topology changes. **(6 MARKS)**

c) Explain how the hybrid topology used in Umoja's redesign supports network reliability. **(5 MARKS)**

d) Describe two ways the transport layer contributed to the overall system's performance. **(5 MARKS)**

e) Discuss how Umoja benefits from separating networking functions into layers using the OSI or TCP/IP models. **(5 MARKS)**

f) Explain how SNMP and QoS monitoring tools would assist in managing a scalable smart grid network like Umoja's. **(5 MARKS)**

QUESTION TWO

a) Describe a scenario where a business might choose a mesh topology over a bus or star topology. Justify your answer. **(5 MARKS)**

b) Discuss two real-world challenges of implementing mesh topologies in rural infrastructure. **(5 MARKS)**

QUESTION THREE

a) Assume you're designing a secure wireless network for a regional bank. Explain how digital and analog transmission would be used in such a network. **(5 MARKS)**

b) With examples, describe how multiplexing enhances communication efficiency in banking networks. **(5 MARKS)**

QUESTION FOUR

a) Using an example from online education platforms, describe how the TCP and UDP protocols differ in their application.

(5 MARKS)

b) Identify two scenarios where UDP is preferred over TCP and explain why.

(5 MARKS)

QUESTION FIVE

a) Explain the concept of error detection at the data link layer and describe two techniques used to ensure reliable data transmission.

(5 MARKS)

b) Using a smart meter application, illustrate how error detection prevents billing inconsistencies. **(5 MARKS)**

QUESTION SIX

a) Describe how a company like Uber or Bolt might use network layer protocols to support routing in its mobile application.

(5 MARKS)

b) List and explain three key differences between IPv4 and IPv6 relevant to app-based transportation services. **(5 MARKS)**