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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

KCS 2201 DATA COMMUNICATION AND NETWORKS

Date: 7TH AUGUST, 2024 Time: 11:30 AM – 2:30 PM

<u>INSTRUCTIONS TO CANDIDATES</u> <u>ANSWER QUESTION ONE (COMPULSORY)</u> AND ANY OTHER TWO QUESTIONS <u>QUESTION ONE: COMPULSORY (30 MARKS)</u>

- a) A network of networks is called an internetwork, or simply the internet. It is the largest network in existence on this planet. The internet hugely connects all WANs and it can have connection to LANs and Home networks. Internet uses TCP/IP protocol suite and uses IP as its addressing protocol. Present day, Internet is widely implemented using IPv4. Because of shortage of address spaces, it is gradually migrating from IPv4 to IPv6.
 - **i.** Expound on the significance of a network/internet to a business
 - **ii.** Compare the structure of a IPv4 address compared to a IPv6
 - iii. Describe four components of data communication
- b) As we know data communication is communication in which we can send or receive data from one device to another. Workstations can be connected by either wired media or wireless media. It is also known as a transmission medium. The transmission medium or channel is a link that carries messages between two or more devices.
 - i. Discuss using a diagram simplex communication mode (4 Marks)
 - **ii.** Distinguish with examples between guided and unguided media
- c) When computers, terminals, and/or other data processing devices exchange data, the procedures involved can be quite complex. Instead of implementing the complex logic for this as a single module, the task is broken up into subtasks, implemented separately. In a protocol architecture, the modules are arranged in a vertical stack, each layer in the stack performs a related subset of the functions. It relies on the next lower layer to perform more primitive functions. It provides services to the next higher layer.
 - i. Describe 4 elements of a protocol
 - **ii.** Using a diagram illustrate a Simplified Network Architecture
- d) Optical fiber is an important technology. It transmits large amounts of data at very high speeds due to which it is widely used in internet cables. Illustrate how a fiber optic cable carries signals.
 (2 Marks)

QUESTION TWO: (20 MARKS)

a) The TCP/IP model covers many internet protocols, which define how data is addressed and sent over the internet. Common internet protocols include HTTP, FTP, SMTP. Using a diagram map the TCP/IP protocol suite to the OSI Model layers.
 (8 Marks)

(4 Marks) (4 Marks) (4 Marks)

(4 Marks) (4 Marks)

(4 Marks)

- **b**) Wireless is a transmission mode in which the signals are propagated from one device to another device wirelessly. Signals can wave through air, water, or vacuum. It is generally used to transmit signals in all directions.
 - Distinguish between a digital and analog signal i.

Discuss three Wireless communication technologies ii.

QUESTION THREE: (20 MARKS)

- a) The TCP/IP protocol architecture is a result of protocol research and development conducted on the experimental packet-switched network, ARPANET, funded by the Defense Advanced Research Projects Agency (DARPA), and is generally referred to as the TCP/IP protocol suite. Within the TCP/IP protocol suite, the TCP and UDP protocols operate at the transport layer, discuss their function and application. (6 Marks)
- b) Standards are the set of rules for data communication that are needed for the exchange of information among devices. It is important to follow Standards which are created by various Standard Organizations like IEEE, ISO, ANSI, etc.
 - With examples expound on 'De Facto' and 'De Jure' Standards i.

Discuss any four layers of the OSI Model ii.

QUESTION FOUR: (20 MARKS)

- a) The arrangement of a network that comprises nodes and connecting lines via sender and receiver is referred to as Network Topology. Network topology plays a major role in how a network function. Namely, the topology has a direct effect on network functionality. Choosing the right topology can help increase performance, as a properly chosen and maintained network topology increases energy efficiency and data transfer rates. Exemplify any four Network topologies. (8 Marks)
- b) A TCP segment consists of data bytes to be sent and a header. The header of a TCP segment can range from 20-60 bytes. 40 bytes are for options. If there are no options, a header is 20 bytes else it can be of upmost 60 bytes. Discuss any four Key IP Packet Format Fields/headers.

(8 Marks)

c) Network Security Compliance refers to the regulations and standards that organizations must comply with to ensure the security of their computer network. It involves implementing security measures and protocols to protect data and systems from unauthorized access, modification, or destruction. Evaluate the significance of Protocol and Standard Compliance in Network Security. (6 Marks)

QUESTION FIVE: (20 MARKS)

- a) Data transmission is the process of transferring digital data (bits or bytes) between two or more devices or systems. It involves sending information from a source to a destination, typically over communication mediums such as cables, optical fibers, or wireless connections.
 - Discuss serial and parallel communication i.
 - Distinguish between synchronous and asynchronous transmission ii.
- b) Data is transmitted through transmission mediums which are not perfect. The imperfection causes signal impairment, in which imperfection error is introduced in the transmitted data - the original signal at the beginning of the transmission is not the same as the signal at the Receiver. Discuss attenuation, noise and distortion. (6 Marks)
- c) Unguided media transport data without using a physical conductor. This type of communication is often referred to as wireless communication. Describe omni-directional and uni-directional (4 Marks) propagation.

(6 Marks) (8 Marks)

(4 Marks)

(6 Marks)

(6 Marks)

(6 Marks)