OFFICE OF THE DEPUTY VICE CHANCELLOR
ACADEMICS, RESEARCH, AND STUDENT AFFAIRS

UNIVERSITY EXAMINATIONS

2024/2025 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

MAIN EXAM

COURSE CODE: BCS 114

COURSE TITLE: DATA COMMUNICATION

DATE: 23RD APRIL 2025 **TIME: 0800-1100 HRS**

INSTRUCTION TO CANDIDATES

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MAIN EXAM
BCS 114: DATA COMMUNICATION
STREAM: BSc (Computer Science) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

i. *Answer **ALL** questions from section A and any **THREE** from section B.*

ii. *Maps and diagrams should be used whenever they serve to illustrate the answer.*

iii. *Do not write on the question paper.*

SECTION A (24 MARKS) COMPULSORY

QUESTION ONE [12 MARKS]

a) Define the following terms:
   i. Data Transmission **[1 Mark]**
   ii. Media **[1 Mark]**
   iii. Data Communication **[1 Mark]**
   iv. Protocol **[1 Mark]**

b) Differentiate between the following terms as relates to data communication:
   i. Half-Duplex and Full Duplex communication. **[2 Mark]**
   ii. Asynchronous Communication and Synchronous Communication. **[2 Mark]**

c) Explain any **FOUR** functions of each of the following OSI model layers:
   i. Transport Layer **[2 Marks]**
   ii. Datalink Layer **[2 Marks]**

QUESTION TWO [12 MARKS]

a) Describe with the aid of a suitable diagram the concept of Frequency Division Multiplexing (FDM), highlighting how frequency overlapping is prevented. **[5 Marks]**

b) Explain any **SIX** attributes of the following Internet Protocol Version Four (IPv4) expression 192.168.40.32/27. **[3 Marks]**

c) Describe the structure of optical fiber media and argue for its use in modern data network. **[4 Marks]**

SECTION B {36 MARKS}

QUESTION THREE [12 MARKS]

a) Discuss any **THREE** Closed Loop congestion control policies in data networks. **[3 Marks]**

b) Analyze any **THREE** factors that impact on data flow rates in mission critical data networks. **[3 Marks]**

c) Identify any **TWO** short-range wireless communication technologies and explain how they are utilized in the enterprise network environment. **[4 Marks]**

d) Defend the ongoing transition from Internet Protocol Version Four (IPv4) to Internet Protocol Version Six (IPv6). **[2 Marks]**

QUESTION FOUR [12 MARKS]

a) Using a suitable diagram explain the circuit switching network technology, highlighting why it is suitable for transmission of time sensitive data over the internet. **[4 Marks]**

b) Discuss the *concept of error control* in data networks, highlighting the nature of errors and available mechanism for error control. **[6 Marks]**

c) Explain the concept of signal attenuation and highlight **TWO** approaches that have been used in the attempt to overcome this challenge in modern data network transmission. **[2 Marks]**

QUESTION FIVE [12 MARKS]

a) The performance of a data network is measured by examining the data transmission latency i.e. delay or simply how long it takes for an entire message to completely arrive at the destination. It is given as;

Latency = propagation time + transmission time + queuing time + processing delay

Describe each component in the expression above, highlighting how they contribute to latency in data networks. **[4 Marks]**

b) Suppose a file of **42 GB** is to be sent over a line at **56kbps**. Calculate the overhead in bits and transmission time in using asynchronous communication. Assume one start bit and a stop

element of length one bit, needed to send a byte of data (character). The 8-bit character consists of all data bits, with no parity bit. **[5 Marks]**

c) Explain any **THREE** possible reasons that could drive the decision to implement a wireless network over cabled network. **[3 Marks]**

QUESTION SIX [12 MARKS]

a) Given the following digital data; **1010011100101**. Represent this data using

i. Two level digital signal representation. **[1 Mark]**
ii. Four Level Signal Representation. **[1 Mark]**
iii. Amplitude Modulation. **[1 Mark]**
iv. Frequency Modulation. **[1 Mark]**
v. Phase Modulation. **[1 Mark]**

b) Computer the transmission time and propagation times of a **15 Gigabyte** message, if the bandwidth of the link is **512.0 Mbps**, the distance between the communication devices is **32,000km** and the propagation speed of the data is **2.4 x 108 m/s**. Assume that the system uses asynchronous transmission and that each byte of data requires one start bit and two stop bits. **[5 Marks]**

c) Explain with the aid of suitable diagrams, the differences between ***Multicast*** and ***Broadcast*** communications in data networks. **[2 Marks]**

QUESTION SEVEN [12 MARKS]

a) Discuss the functions of "*Dynamic Routing Protocols*" in an enterprise Network and give **FOUR** examples of such protocols. **[6 Marks]**

b) Explain any **THREE** factors that influence the performance of a data network. **[3 Marks]**

c) Discuss any **THREE** types of noises in data communication networks and point out how each type affect signal quality of the data transmitted. **[3 Marks]**

END OF EXAM