

UNIVERSITY OF RUHUNA
BACHELOR OF SCIENCE (GENERAL) DEGREE
LEVEL II (SEMESTER II) EXAMINATION – FEBRUARY 2018

COM221β – Data Communication & Computer Networks

Duration: 2 hours

Answer four (4) questions ONLY

1.

- a) Briefly explain **Bit Interval** and **Bit rate** related to **Digital Signals**.
- b)
 - i. State the **three (3)** types of **Transmission Modes** under **Serial Transmission**.
 - ii. Briefly describe the technique of **Companding** that is used in **PCM (Pulse Code Modulation)**
- c)
 - i. State **two (2)** differences between **Broadband Digital Transmission** and **Baseband Digital Transmission**.
 - ii. Plot the bit stream given below using the **Bipolar** encoding. Name the axes clearly.

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 - iii. A network with bandwidth of **12 Mbps** can pass only an average of **18,000** frames per minute with each frame carrying an average of **10,000** bits. Calculate the **throughput** of this network in **Mbps** (Consider 10^6 bits = 1 Mb)
- d) Assume that there is a channel with a **1 KHz** bandwidth. The **SNR (Signal to Noise ratio)** for this channel is **255**. Answer the following questions. (State the equations used in the calculations clearly)
 - i. Calculate the **upper limit** of the data rate of this channel.
 - ii. If the bit rate is selected as **4 Kbps**, calculate the number of signal levels.

2.

a)

- i. Briefly explain the difference between **Guided Transmission media** and **Unguided Transmission media**.
- ii. State **two (2)** main factors that the data rate of a **Twisted Pair** cable depends on.

b)

- i. What are the **three (3)** components of **Fiber Optics**?
- ii. State **three (3)** example usages of **Fiber Optics** in communication.

c)

- i. Briefly explain the **Thermal Noise** and **Induced Noise**.
- ii. A signal travels from point A to B. At point B, the **amplification** of the signal is **10dB**. If the power of the signal at point B is **20W**, what was the power of the signal at point A?
- iii. The average power of a signal travelling through a medium is **1W**. The average noise power of in the signal is **100mW**. Calculate the **Signal to Noise ratio** in **decibels (SNR_{dB})**. Clearly mention the equations used for the calculation.

d) Using an appropriate diagram, explain what is meant by a **Band Pass** channel.

3.

a)

- i. State the **three (3)** phases of **Circuit Switching**.
- ii. The packet headers used in **Datagram Packet switched** networks contain more information than the packet headers used in **Virtual Circuit Packet switched** networks. Briefly explain the reason for this.

b)

- i. Which of the **three (3)** multiplexing techniques can be used in **Fiber Optics** communication? Explain your answer.
- ii. Assume that **twenty (20)** 100Kbps digital sources are multiplexed using **Time Division Multiplexing (TDM)**. If the multiplexing unit is **1 bit**, calculate the followings.
 - A. Input bit duration.
 - B. The transmission rate of the link.
 - C. The duration of a time slot.

c)

- i. Match the layer name in the left column with the appropriate layer functionality in the right column of the following table.

Layer Name	Layer Functionality
Application	A-responsible for providing services to the user
Presentation	B-responsible for delivery of individual packets from source to destination
Network	C-responsible for delivery of a message from one process to another
Transport	D-responsible for moving frame from one hop to next
Data link	E-responsible for translation, compression, and encryption.
Physical	F-responsible for movements of individual bits from one hop (node) to the next.

- ii. Write down three layers of the OSI model that are equivalent to the functions of the application layer of the TCP/IP model?
- d) Explain how ARP resolves an IP address to an Ethernet MAC address.
- e)
 - i. Match the Address in the left column with the appropriate example in the right column of the following table.

Address	Example
Private IP address	192.248.48.0
Class A IP Address	192.248.48.255
Class C IP Address	255.255.255.0
/24 Subnet Mask	10.48.2.10
/24 Broadcast Address	126.2.48.254
/24 Network Address	221.2.48.1

- ii. Write two differences between private IP address and public IP address.

4.

- a) Explain the difference between **direct** and **indirect** delivery in a TCP/IP network using suitable examples.
- b) A block of IP addresses is granted to a small organization. We know that one of the addresses is 200.10.30.34/25. What are the first address, last address and block size of this IP block?
- c)
 - i. Name two(02) well known transport layer protocols provided by the TCP/IP protocol stack and provide a brief description of each protocol.
 - ii. What is the role of a port number in the transport layer?
- d) You are asked to subnet the 192.28.48.0/24 IP address block to the following subnets.

Subnet Name	Number of Hosts
Faculty of Science	112 hosts
Faculty of Technology	30 hosts
Faculty of FMST	25 hosts
Faculty of Management	25 host
General Administration	18

Write down each subnet in CIDR form and each subnet's first and last valid IP that can be assigned to hosts.

5.

a) Write down two main function of a router and describe each of them separately.

b)

i. Write down four different types of network security attacks possible for an commercial organization

ii. Write four(4) security services provided for message exchange in a network and explain two of them briefly.

c)

i. Explain how to find the network address from an IP address and its corresponding net- mask.

ii. Consider the following routing table.

Destination	Mask	Interface
200.24.50.0	255.255.255.0	M0
130.192.0.0	255.255.0.0	M1
130.191.96.0	255.255.240.0	M2
130.191.112.0	255.255.240.0	M3
130.191.80.0	255.255.240.0	M4
130.191.0.0	255.255.0.0	M5
0.0.0.0	0.0.0.0	M6

Determine the outgoing interface for the packets with the following destination addresses.

1) 130.193.140.41

2) 130.192.102.3

3) 130.191.92.12

4) 130.191.170.50

d)

i. What is the main function of the DNS?

ii. Describe MTA and MUA with respect to the email system.