



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**SCHOOL INFORMATICS AND INNOVATIVE SYSTEMS**  
**UNIVERSITY EXAMINATION FOR THE DEGREE OF SCIENCE**  
**COMPUTER SECURITY & FORENSICS**  
**1<sup>ST</sup> YEAR 2<sup>ND</sup> SEMESTER 2013/2014 ACADEMIC YEAR**  
**CENTRE: MAIN**

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**COURSE CODE: IIT 3121**

**COURSE TITLE: DATA COMMUNICATION PRINCIPLES**

**EXAM VENUE: LR 2**

**STREAM: BSc. Computer Security & Forensics**

**DATE: 9/12/2013**

**EXAM SESSION: 11.30 – 1.30 PM**

**TIME: 2 HOURS**

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**Instructions:**

- 1. Answer question 1 (Compulsory) and ANY other 2 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.**

## Question 1

- a) Using diagram(s), Compare OSI Model and TCP/IP Model. (8 Marks)
- (i) Which layer of the OSI model ensures reliable, end-to-end communications? (2 Marks)
- (ii) Which layer of the OSI model provides routing functionality? (2 Marks)
- (iii) Which layer of the OSI model translates the data from upper-layer protocols into electrical signals and places them on the network media? (2 Marks)
- b) How is the transmission of a single character differentiated from the transmission of the next character in asynchronous transmission? (2 Marks)
- c) Explain two reasons why most communication systems use serial mode as compared to parallel communication mode. (2 Marks)
- d) Briefly explain the difference between hub, bridge, switch and a router. Among the listed devices, which the device(s): (8 Marks)
- e) Any periodic signal can be represented as a sum of sinusoids, known as a Fourier series:1

$$x(t) = \frac{A_0}{2} + \sum_{n=1}^{\infty} [A_n \cos(2\pi n f_0 t) + B_n \sin(2\pi n f_0 t)]$$

Given that  $f_0 = 1/T$  and  $A_0$  is not equal to zero. Write equations which would be used to calculate the coefficients:

**A<sub>0</sub>**

**A<sub>n</sub>**

And

**B<sub>n</sub>**

(3 Marks)

- f) Define the following terms as used in Data Communication: (3 Marks)
- I. Little endian
- II. Asynchronous data transmission
- III. Simplex Communication

## Question 2

- a) Why is multiplexing so cost-effective? (2 Marks)
- b) Explain how interference avoided by using frequency division multiplexing? (3 Marks)
- c) Define the term echo cancellation as used in data Communication. (3 Marks)
- d) What is the meaning of upstream and downstream with respect to subscriber lines. (2 Marks)
- e) Explain how synchronous time division multiplexing (TDM) works. (2 Marks)
- f) A character-interleaved time division multiplexer is used to combine the data streams of a number of 110-bps asynchronous terminals for data transmission over a 2400-bps digital line. Each terminal sends asynchronous characters consisting of 7 data bits, 1 parity bit, 1 start bit, and 2 stop bits. Assume that one synchronization character is sent every 19 data characters and, in addition, at least 3% of the line capacity is reserved for pulse stuffing to accommodate speed variations from the various terminals.
- i. Determine the number of bits per character. (3 Marks)
  - ii. Determine the number of terminals that can be accommodated by the multiplexer. (3 Marks)

## Question 3

- a) Explain five factors that can be used in evaluating or comparing the various digital-to-digital encoding techniques. (10 Marks)
- b) i) What is meant by differential encoding? (2 Marks)
- ii) Describe two multilevel binary digital-to-digital encoding techniques. (2 Marks)

- iii) Define biphase encoding and describe two biphase encoding techniques. (2 Marks)
- iv) Explain the function of scrambling in the context of digital-to-digital encoding techniques. (3 Marks)
- v) What function does a modem perform in a communication network ? (1 Mark)

#### Question 4

- a) How is the transmission of a single character differentiated from the transmission of the next character in asynchronous transmission? (2 Marks)
- b) Explain one major disadvantage of asynchronous transmission? (2 Marks)
- c) How is synchronization provided for synchronous transmission? (3 Marks)
- d) Define a parity bit? (2 Marks)
- e) What is the CRC? (2 Marks)
- f) Why would you expect a CRC to detect more errors than a parity bit? (2 Marks)
- g) List three different ways in which the CRC algorithm can be described (3 Marks)
- h) In an  $(n, k)$  block ECC, what do  $n$  and  $k$  represent? (2 Marks)
- i)
- j) What is the role of a DCE in a communication network (2 Marks)

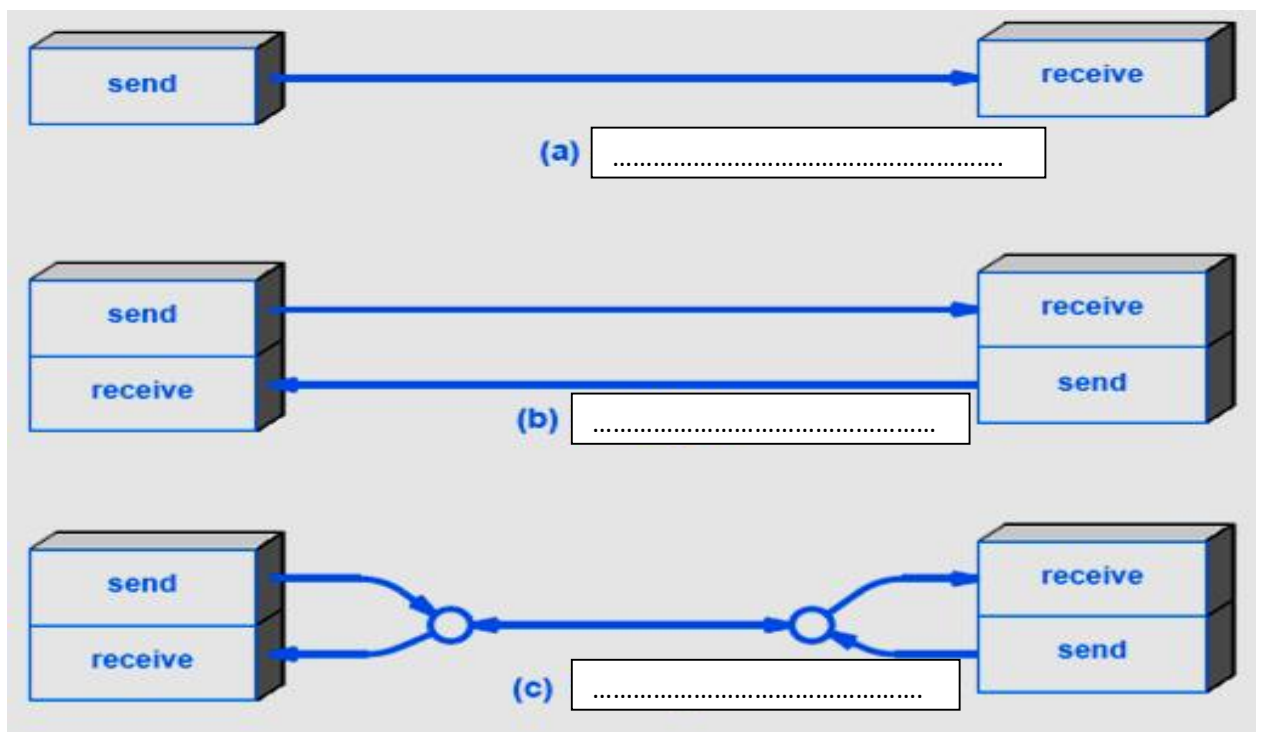
#### Question 5

- a) Explain Five requirements for effective communications over a data link network. (10 Marks)
- b) Define flow control. (2 Marks)
- c) Describe stop-and-wait flow control. (1 Marks)
- d) Explain two reasons for breaking a long data transmission up into a number of frames. (2 Marks)

- e) Describe sliding-window flow control. (2 Marks)
- f) Define error control. (1 Marks)
- g) Explain two common ingredients for error control for a link control protocol. (2 Marks)

**QUESTION 6**

- a) i) define data communication as used in data transmission (2 Marks)
- b) Differentiate between synchronous and asynchronous data transmission (4 Marks)
- c) Identify the following communication channels and give an example of each of a communication device using this mode of communication (6 Marks)



- d) Explain four data transmission media . (4 Marks)