



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**SCHOOL OF INFORMATICS AND INNOVATION SYSTEMS**  
**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE**  
**BIOLOGICAL**  
**2<sup>ND</sup> YEAR 1<sup>ST</sup> SEMESTER 2013/2014 ACADEMIC YEAR**  
**REGULAR**

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**COURSE CODE: SCS 3231**

**COURSE TITLE: DATA COMMUNICATION AND NETWORKS**

**EXAM VENUE: CR**

**STREAM: (SIIS)**

**DATE: 24/04/14**

**EXAM SESSION: 9.00 – 11.00 AM**

**TIME: 2.00 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 one (30 marks)**

- a) Differentiate between data communication and data networks. **(2 marks)**
- b) Give the fundamental equation for a sinusoidal wave and clearly define what each term means and the standard unit for each term. **(3 marks)**
- c) Define the following terms:
  - i) Spectrum
  - ii) Bandwidth
- d) What are the three main causes of transmission impairments. **(3 marks)**
- e) Consider the sinusoidal function given

$$s(t) = 20 + \sin(2\pi ft) + \frac{1}{3} \sin(6\pi ft) + \frac{1}{5} \sin(10\pi ft)$$

Where  $f = 10^6$  Hz.

- i) What is the amplitude  $A$ , for the sinusoidal function? **(1 mark)**
  - ii) What is the spectrum of the wave? **(2 marks)**
  - iii) What is the period,  $T$  of the wave? **(2 marks)**
  - iv) What is the effective bandwidth,  $B$  of the wave? **(2 marks)**
- f) Give the three ways in which wave propagation occurs. (Use diagrams).  
What are the operating frequencies for each propagation method. **(6 marks)**
- g) How many hosts and subnets can you get from the network 172.28.0.0  
255.255.255.0? **(2 marks)**
- h) State three modulation techniques that are used in encoding of analog data  
to analog signals. **(3 marks)**
- i) State the four dimensions that multiplexing of data transmission can be  
done. **(4 marks)**

**Question two (20 marks)**

- a) Draw the simplified communication model and explain what each  
component is for. **(8 marks)**
- b) Differentiate between Wide Area Networks (WANs) and Local Area  
Networks (LANs). **(2 marks)**
- c) Define channel capacity **(2 marks)**

- d) Consider a voice channel with BW of 2.8 kHz. A typical value of S/N for a telephone line is 20dB. Using Shannon Capacity, calculate the channel capacity. (6 marks)
- e) Which subnet does host 172.16.170.63/25 belong to? (2 marks)

**Question three (20 marks)**

- a) Using a diagram, describe the three different types of network topologies. (6 marks)
- b) Briefly describe the two types of transmission media. Give an examples for each type. (4 marks)
- c) Encode 00110100110101 using the following digital encoding formats.
- i) Nonreturn to Zero-Level (NRZ-L) (2 marks)
  - ii) Nonreturn to Zero Inverted (2 marks)
  - iii) Bipolar AMI (2 marks)
- d) State and briefly describe the two main switching technologies. (4 marks)

**Question Four (20 marks)**

- a) Draw the ISO/OSI and TCP/IP models. (8 marks)
- b) Differentiate routing and forwarding as used in networks. (2 marks)
- c) Briefly discuss the three main types of routing strategies. (6 marks)
- d) Discuss frequency division multiplexing and time division multiplexing briefly. (4 marks)

**Question Five (20 marks)**

- a) Briefly discuss terrestrial and satellite microwaves. (4 marks)
- b) What is the required receive power threshold,  $P_r$  of the receiver given two parabolic antennas have diameter,  $D = 1$  meter, frequency,  $f = 5$  GHz, transmit power,  $P_t = 1$ W and distance,  $d = 1$  km. (Hint: Effective Area of a parabolic antenna =  $0.55 \times$  physical area) (8 marks)
- c) One method used in error control is called automatic repeat request (ARQ). State the three versions of ARQ. (3 marks)
- d) Using a suitable diagram showing a random analog signal, code the signal using delta modulation into a digital signal. (5 marks)