# Exam 2015, questions

data communications (Africa Nazarene University)

# AFRICA NAZARENE
## UNIVERSITY

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| **CENTRE:** | **RONGAI** |
| **DEPARTMENT:** | **COMPUTER SCIENCE** |
| **UNIT TITLE:** | **DATA COMMUNICATIONS** |
| **UNIT CODE:** | **CSC 207** |
| **LECTURER:** | **J. ARIMBI** |
| **TRIMESTER:** | **2$^{ND}$ TRIMESTER 2014/2015** |
| **DATE:** | **7$^{TH}$ APRIL, 2015** |
| **TIME:** | **9.00AM – 12 NOON** |

## Instructions:

1. Answer question **ONE** in **Section A (Compulsory)** and any other **THREE** in **Section B**

2. Write all your answers in the answer booklet provided.

3. Time allowed: Three hours.

**Section A: (Compulsory)**

**Question One: (30 Marks)**

a. A cell phone user through a satellite link from the US to Kenya complains of a time delay in the conversation over the voice channel.

    i)        Explain the cause of the time delay.             **(3 marks)**

    ii)       Determine the time delay assuming the satellite is 42000Km from the earth. (Velocity of electromagnetic waves in free space = $3 \times 10^8$ m/sec)

                                                              **(3 marks)**

b. Distinguish between parity check code and hamming code techniques of error detection and error correction in terms of:

    i)        Principle underlying the techniques             **(3 marks)**

    ii)       Number of errors detected and corrected        **(3 marks)**

c. Space wave is a mode of radio wave propagation used with unguided media.

    i)        Use a sketch diagram to illustrate and explain this mode of radio propagation

                                                             **(2 marks)**

    ii)       Explain **two** features or phenomenon that may improve the range of propagation beyond the line of sight                  **(2 marks)**

    iii)    List **two** typical applications of this mode of propagation.      **(2 marks)**

d.  i)   State the sampling theorem.                        **(2 marks)**

    ii)       With reference to pulse code modulation (PCM) explain the phases of analog to digital conversion.                         **(2 marks)**

    iii)    What errors arise from this technique and how are they minimized?

                                                               **(2 marks)**

e. Multiplexing is a useful tool in data communication:

    i)        What is the need for multiplexing base band channels before transmission?

                                                             **(2 marks)**

    ii)       TDM, FDM and WDM. Are typical multiplexing techniques. What do the acronyms stand for? Classify them as analog or digital        **(2 marks)**

iii)     Outline the principle of WDM multiplexing technique and state where it is used.

**(2 marks)**

## SECTION B: ANSWER THREE QUESTIONS FROM THIS SECTION

### Question Two: (10 Marks)

A communication system conveys seven possible messages with probabilities of M1=0.02, M2=0.30, M3=0.15, M4=0.20, M5=0.10, M6=0.05 and M7=0.18 respectively. Model the messages for transmission using Huffman code and determine:

i)   Maximum information content H (max)                    **(4 marks)**

ii)  Average information content (Entropy) H(A) of the  source      **(4 marks)**

iii) Efficiency of the code                                **(2 marks)**

### Question Three: (10 Marks)

a)  Distinguish between entropy coding and Channel coding.        **(2 marks)**

b)  A message data stream is given as 1110010001110

i)   Generate a message polynomial M(x) in terms of x that can be used for cyclic redundancy check                                          **(2 marks)**

ii)  Suggest a generator polynomial P(x) that can be used with the message polynomial in i) above                                        **(2 marks)**

a)  Two code words are given as M1=10011001 and M2= 10100111.  Determine

i)   The hamming distance of the code words              **(2 marks)**

iii) Error control capability of the hamming distance in i) above.   **(2 marks)**

### Question Four: (10 Marks)

a)  Define the term modulation index with reference to a modulated wave. Hence sketch diagrams for the following modulation scenarios for amplitude modulation:

i)    modulation index=1

iii)     Over modulation                                   **(4 marks)**

b)  With the aid of sketches, distinguish between the principles of the following methods of modulation: frequency modulation (FM) and phase modulation (PM).      **(4 marks)**

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c) How do you rate FM and PM in terms of signal quality and power consumption?

**(2 marks)**

## Question Five: (10 Marks)

a) Distinguish between message switching and packet switching in terms of circuit establishment, data transfer and circuit termination.          **(5 marks)**

b) With the aid of a sketch diagram, explain how an application is communicated between **two** remote computers using the ISO/OSI model.          **(5 marks)**