



# THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

**A. M. E. C. E. A**

P.O. Box 62157  
00200 Nairobi - KENYA  
Telephone: 891601-6  
Fax: 254-20-891084  
E-mail: academics@cuea.edu

**MAIN EXAMINATION**

**JANUARY – APRIL 2015 TRIMESTER**

**FACULTY OF SCIENCE**

**DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE**

**REGULAR PROGRAMME**

**CMT 418: MULTIMEDIA SYSTEMS**

<b>Date: APRIL 2015</b>	<b>Duration: 2 Hours</b>
<b>Instructions: Answer Question ONE and any other TWO Questions.</b>	

- Q1. a) Describe the desirable properties of a multimedia system. **(4 marks)**
- b) State Nyquist's sampling theorem. **(4 marks)**
- c) Describe the considerations that affect the selection of the sampling rate in multimedia data. **(4 marks)**
- d) For each of the following media types; audio, graphics, images, video & animation briefly describe how sampling affects their quality indicating how they manifest in each. **(14 marks)**
- Q2. a) Describe the different properties of an audio signal. **(10 marks)**
- b) Describe briefly how a condition reverb is implemented indicating the fundamental theorem used. **(6 marks)**
- c) Explain why motion compensation is used in MPEG Video. Compression. **(4 marks)**
- Q3. a) Differentiate between I-frames, P-frames, and B-frames. **(4 marks)**
- b) Consider the following block of frequency domain values from a video frame arising during MPEG compression.

196	207	1	129
1	7	129	199
11	7	73	194
75	78	139	135

Apply successively to this block.

- i) MPEG quantization using constants quantization value of 64
- ii) Zig-zag Scanning
- iii) Run length encoding

**(14 marks)**

- Q4. a) Explain why lossy data compression is preferred sometimes over lossless. **(4 marks)**
- b) Consider the following  
 ... GRACCCGACACTTCCCCTTC ...  
 Assume that the frequency of symbols in the rest of the sequence are the same as in this fragment. Estimate the probabilities of each symbol {A,G,T,C} and hence derive the Huffman Code for each. Estimate the average number of bits per symbol required to encode the sequence using Huffman Code under these circumstances. **(12 marks)**
- c) Outline the advantages of Huffman Coding over arithmetic coding. **(4 marks)**
- Q5. a) Describe how entropy encoding and transform encoding techniques work. **(8 marks)**
- b) Differentiate between depth and resolution as used in image representation. **(4 marks)**
- c) Briefly explain how a digital camera is used to acquire an image. **(4 marks)**
- d) Differentiate between animation and video as used in multimedia systems. **(4 marks)**

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