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*(Knowledge for development)*

**KIBABII UNIVERSITY  
(KIBU)**

**UNIVERSITY EXAMINATIONS  
2020/2021 ACADEMIC YEAR**

**SPECIAL/SUPPLEMENTARY EXAMINATIONS  
YEAR FOUR SEMESTER TWO EXAMINATIONS**

**FOR THE DEGREE OF  
BACHELOR OF SCIENCE  
(COMPUTER SCIENCE)**

**COURSE CODE : CSC 455E**  
**COURSE TITLE : DIGITAL AUDIO TECHNOLOGIES**

**DATE: 19/01/2022 TIME: 8.00 A.M – 10.00 A.M**

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**INSTRUCTIONS TO CANDIDATES**

**ANSWER QUESTIONS ONE AND ANY OTHER TWO.**

## QUESTION ONE [COMPULSORY- 30 MARKS]

- (a) (i) What is an audio signal? [2 marks]
- (ii) Digitization of audio signal involves two main steps, sampling and quantization. Briefly describe the two steps [6 marks]
- (b) State and explain the roles of four common audio processors in digital audio systems [8 marks]
- (c) Briefly explain the Nyquist theorem concept as applied in digital audio signal processing [4 marks]
- (d) Define the following terms applicable in digital audio processing
- (i) Bit depth [2 marks]
  - (ii) Quantization error [2 marks]
  - (iii) Auditory perception [2 marks]
  - (iv) Critical band [2 marks]
- (e) State any two forms of audio coding formats and briefly describe each format [2 marks]

### QUESTION TWO [20 MARKS]

- (a) Differentiate between microphones and loudspeakers and briefly describe three characteristics for each case [5 marks]
- (b) In reference to data compression for digital audio systems, briefly describe and differentiate the following coding methods
- i. Run Length Coding for Binary Files [3 marks]
  - ii. Huffman coding [3 marks]
  - iii. Arithmetic Coding [3 marks]
- (c) Briefly describe the following three forms of audio coding file formats in digital audio systems
- i. Waveform Audio File Format [2 marks]
  - ii. AU File Format [2 marks]
  - iii. RealAudio [2 marks]

### QUESTION THREE [20 MARKS]

- (a) What is digital audio broadcast? [2 marks]
- (b) In Pulse Code Modulation, state three problems associated with uniform quantization [3 marks]
- (c) Illustrate using block diagrams the basic element of the PCM system from the transmitter, transmission path to the receiver and vice versa [4 marks]
- (d) State four advantages of Pulse Code Modulation [4 marks]
- (e) Differentiate between Adaptive Differential Pulse Code Modulation and Delta Modulation techniques and state their application in each case [4 marks]
- (f) In Dolby DTS, Direct Stream Transfer is a very complex coding method that uses three stages. List the three stages adopted by Dolby DTS [3 marks]

#### QUESTION FOUR [20 MARKS]

- (a) Differentiate between fundamental waveform and harmonics and illustrate harmonics in schematic form up to the 4<sup>th</sup> harmonic [6 marks]
- (b) Briefly explain the following methods of sound synthesis
- (i) Additive synthesis [1.5 marks]
  - (ii) Non-Linear Synthesis [1.5 marks]
  - (iii) FM Synthesis [1.5 marks]
  - (iv) Wavetable Synthesis [1.5 marks]
- (c) State the meaning of the following terms applicable in audio production
- i. Reverberation [1 mark]
  - ii. Depth perception [1 mark]
- (d) Discuss three reflection issues for room design to achieving good acoustics in a concert hall or studio [6 marks]

#### QUESTION FIVE [20 MARKS]

- (a) Sound can be described in two ways, by their frequency and by their intensity. Differentiate between the two terms [4 marks]
- (b) Explain the following terms as pertains to nonlinear synthesis of sound
- (i) Waveshaping [3 marks]
  - (ii) Phase distortion [3 marks]
- (c) Define the term auditory human perception and briefly describe the range of human hearing [4 marks]
- (d) Briefly explain the terminology “depth perception” in relation to human auditory perception [2 marks]
- (e) Briefly explain the concept of Internet Radio Broadcast and its applications [4 marks]