UNIVERSITY OF RUHUNA
BACHELOR OF SCIENCE (GENERAL) DEGREE
LEVEL II (SEMESTER II) EXAMINATION – JANUARY 2018

COM222β – Multimedia Technologies **Duration: 2 hours**

Answer *four (4)* questions *ONLY*

1.

a)

i. Briefly explain the difference between **Discrete Multimedia** and **Continuous Multimedia**.

ii. Explain one example application of **Multimedia** in **Science & Technology** with its advantage.

b)

i. Explain the difference between **Differential Pulse Code Modulation (DPCM)** and **Adaptive Differential Pulse Code Modulation (ADPCM)**.

ii. Assume that a sound signal is sampled at **48.5 kHz** rate. If **eight (8)** levels are used in **Quantization** under **Pulse Code Modulation (PCM)**, calculate the **bit rate** of the digitized audio.

c) Assume that the maximum frequency of an audio is **50 kHz**. This audio is sampled at **96 kHz** for storing in a DVD disc.

i. State any problem that can occur as using the above sampling rate to sample the given audio.

ii. What is the **maximum input frequency** that can be fully recovered using the given sampling rate?

iii. Calculate the **minimum sampling rate** that can be used for the given audio.

iv. Briefly explain the theory you used for the calculations in **(c) (ii)** & **(c) (iii)**.

Continue...

d) **"Structured audio can be transmitted through a low-bandwidth channel".** Briefly explain the reason for this.

2.

a) Suppose that a set of high quality images have been taken for publishing on a web page. Those images are to be compressed and to be stored in a storage medium. Among **lossless** and **lossy** compression methods, what is the most appropriate compression type for this task? Explain your answer.

b) Given below are some characters with their corresponding binary representation in a particular system.

A : 00111
B : 01010
C : 11110
T : 00011

i. Obtain the **bit stream (binary representation)** for the word **CAT**.

ii. Apply **Run-Length encoding** for the bit stream obtained in **(b) (i)**. (Consider 0 and 1 as symbols)

c) Assume that there is a text file containing only five characters. Following table shows those characters with their corresponding frequencies.

Character	K	L	M	N	A
Frequency	7	2	2	17	22

i. If **three (3)** bits are allocated for each symbol (character), calculate the size of the given text file in bits.

ii. Calculate the probability of each symbol.

iii. Based on the values calculated in **(c) (ii)**, derive the **Huffman code** for each symbol above.

iv. Calculate the size of the compressed file obtained after applying the **Huffman codes** in **(c) (iii)** and hence calculated the **compression ratio**.

Continue...

v. Estimate the **average number of bits per symbol** required to encode the given file using the **Huffman code**.

d) Briefly explain **Frequency Masking** and **Temporal Masking** in sounds.

3.

a)

i. Briefly explain what **Interlaced Scanning** is in video scanning.

ii. Describe **Spatial Redundancy** and **Temporal Redundancy** in video compression.

b) ***"RGB Primaries are additive"***. Explain this statement.

c) Suppose there is a video with **1280×720** pixel resolution. The frame rate of this video is **25 fps (frames per second)**.

i. Calculate the bit rate of this video under **no chroma subsampling**.

ii. If **4:2:0 chroma subsampling** is applied, what is the bit rate of this video?

d) Given below is a **Discrete Cosine Transformation (DCT)** matrix of an image.

$$\begin{bmatrix} 214 & 49 & 20 & -10 \\ 34 & -25 & 13 & 5 \\ -6 & -4 & -9 & -3 \\ 5 & 9 & -8 & 3 \end{bmatrix}$$

i. Applying the following **quantization matrix**, obtain the **quantized value matrix** of the above matrix

$$\begin{bmatrix} 16 & 11 & 16 & 24 \\ 12 & 12 & 19 & 26 \\ 14 & 13 & 24 & 40 \\ 24 & 35 & 55 & 64 \end{bmatrix}$$

ii. What is the output after applying **zig-zag scanning** to the **quantized value matrix** obtained in **(c) (i)**?

iii. Apply **Run Length Coding** for the values obtained in **(c) (ii)**.

Continue...

4.

a)

i. Briefly explain how videos are compressed in **Block Based Motion Compensation**.

ii. What is meant by **Bidirectional Motion Compensation**?

b)

i. State **two (2)** main differences between **I-frame** and **B-frames** used in **MPEG-1**.

ii. Explain the structure of a **Macroblock** used in **H.261 standard**.

c)

i. Briefly describe the **three (3)** types of scalabilities in **Scalable Coding** under **MPEG-2**.

ii. "*Most of sport video scenes can be compressed efficiently using **Sprite Coding** under **MPEG-4***". Briefly explain the reason for this.

iii. State **two (2)** applications of **MPEG-4**.

d)

i. List the main elements in **MPEG-7**.

ii. State **three (3)** parts of **MPEG-21** standard.

iii. Define the term **Digital Item** used in **MPEG-21**.

Continue...

5.

a)

i. What is the main difference between the **image compression** approaches in **JPEG 2000** and **baseline JPEG**?

ii. Suppose an image to be processed in different pixel resolutions. Explain the advantage of using **JPEG 2000** standard for this task.

b) Describe the basic steps of **Continuous Multimedia** production.

c)

i. State **three (3)** tasks of **Audio Editing**.

ii. Give **two (2)** examples for **sound editing software**.

iii. Briefly explain the difference between **Pseudo Color** images and **True Color** images in terms of pixel storage.

d) .

i. State the **three (3)** types of lights used in **Three Point Lighting** in video production.

ii. Describe **two (2)** factors to be considered when selecting a compression technique for compressing a video.