

Question 1 (Total 25 Marks)

This question examines your understanding of the different number system representations and the properties of the sampling theorem.

- (a) Demonstrate your understanding of number system representations by converting the following decimals to binary numbers. Note that the integer part of the binary representation is 8-bits in length.
- 26
 - 26
 - 4.625
 - 4.625

(8 marks)

- (b) A representation of the A/D system in frequency domain is given in Figure Q1(b). The frequency domain representation of an input signal to the A/D system is depicted in the same figure.

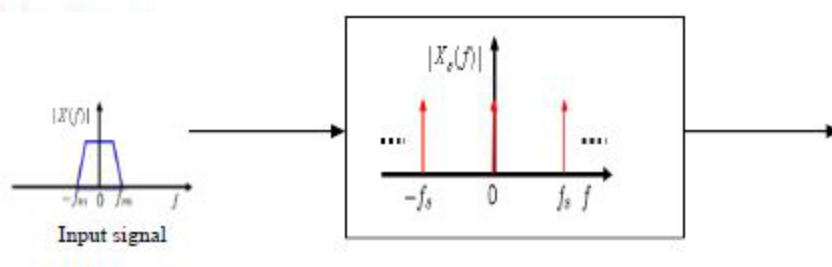


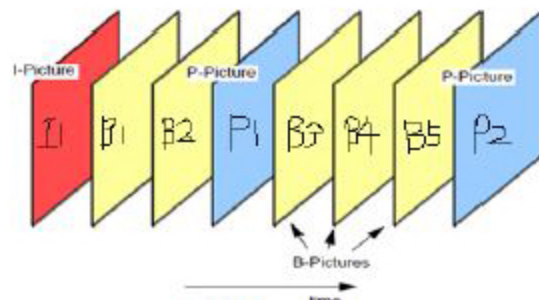
Figure Q1(b)

- Describe frequency domain representation of the output from the A/D converter system by means of a diagram. (6 marks)
 - What would cause aliasing during the A/D conversion? Sketch the frequency domain representation of the output from the A/D system if aliasing occurs during conversion. (5 marks)
- (c) Differentiate between progressive scan and interlaced scan through a brief explanation. (6 marks)

Question 2 (Total 25 Marks)

This question will assess your understanding of video signal parameters, chroma sampling and how to carry out raw video data rate calculations.

- It is well known that human eyes are more sensitive to luminance than chrominance. Chroma subsampling (Color subsampling) is a useful tool in video encoding process. Draw the diagram of a 4:2:0 co-site sampling scheme. (5 marks)
- There is a CIF video sequence with format 352x288@120I. The colour sampling scheme is 4:2:0. Each pixel is encoded into 8 bits. Determine the raw bit rate of this CIF video sequence. (5 marks)
- In a typical MPEG-2 video system, there are 3 types of frames, which are I-frame, P-frame and B-frame respectively.
 - Briefly describe the function of each frame type. (5 marks)
 - From Figure Q2(c)(ii), showing a MPEG-2 Group of pictures (GOP), determine the encoding sequence of the GOP.



(5 marks)

- (d) List TWO SD video formats and THREE HD video formats. (5 marks)

Question 3 (Total 25 Marks)

This question assesses your ability to apply knowledge of components of the video codec, frame types, reference frames and decoding sequence for recording and broadcast applications.

- H.261 is the first video coding standard, which was targetted for teleconference over ISDN. Draw the block diagram of a H.261 encoder and briefly explain function of each block. (6 marks)
- List at least 3 possible techniques we can deploy in order to improve the H.261 coding efficiency. (5 marks)
- Video coding is implemented in a layered structure. Among those layers, the highest layer is video sequence, followed by Group of Pictures (GOP).
 - List the remaining 4 layers (4 marks)
 - Determine the level in which DCT is performed and which level when ME/MC is performed. (2 marks)
- Given an HD video format (1920x1080@30P), calculate the total number of macroblocks (MBs) in luminance plane. (4 marks)
- Explain the human sight deficiency of colour-blindness. (4 marks)

Question 4 (Total 25 Marks)

This question examines your understanding of the terms, transmission errors and video broadcasting techniques.

- With the help of diagrams, briefly explain the concepts of True Video-on-Demand and Near Video-on-Demand. (6 marks)
- With the aid of an example, briefly explain how a parity bit can correct transmission errors. (6 marks)
- Why is modulation is applied before signal transmission and demonstrate your understanding of how DQPSK coding functions. (7 marks)
- Draw the block diagram of a DVB transmission system and briefly explain the function of each component. (6 marks)