

MULTIMEDIA COMMUNICATIONS  
(CT-516)

**Instructions:**

- Attempt All Questions.
- All Questions Carry equal Marks.

Q.1. (a) All the information relating to a compressed image/picture generated by the various stages in the JPEG encoder is encapsulated within a single frame in such a way that the decoder can identify the individual fields that are present. Show the structure of a frame in a diagram and describe the role of the main field in each of the headers that are used. (7)

Q.1. (b) A digitalized video is to compress using the MPEG-1 Standard assuming a frame sequence of

IBBPBBPBBPBBBI...

And average compression ratio of 10:1 (I), 20:1 (P) and 50:1 (B), Drive the average bit rate that is generated by the encoder for both the NTSC and PAL digitalization format. (7)

Q.2. (a) With the aid of a diagram explain the principles of operation of movie/video on demand. Identify the bandwidth requirement associated with this type of application. (4)

Q.2. (b) What is the limiting factor associated with movie/video on demand. (5)

Q.2. (c) Derive the scaling factors used for both the U and V (as used in PAL) and I and Q (as used in NTSC) color difference signals in terms of the three R, G, B color signals. (5)

Q.3. (a) A statistical encoding algorithm is being considered for the transmission of a large number of long text files over a public network. Analyses of the file contents has shown that each file comprises only the six different characters M, F, Y, N, 0 and 1 Each of which occurs with a relative frequency of occurrence of 0.25, 0.25, 0.125, 0.125, 0.125 and 0.125 respectively. If the encoding algorithm under consideration uses the following set of code words: M=10, F=11, Y=010, N=011, 0=000, 1=001, Compute: (i) the average number of bits per codeword with the algorithm, (ii) the entropy of the source, (iii) the minimum number of bits required assuming fix length code words. (8)

Q.3. (b) Symbols A, B, C, D, E, are being produced by the information source with probabilities 0.4, 0.25, 0.2, 0.1, 0.05 respectively. Construct the binary Huffman code and Compute Code Efficiency. (6)

Q.4. (a) State and explain the elements of Digital Signal Processing with respect to Multimedia Communication. Also discuss correlation properties among different communication planes.

Q.4. (b) A 1024-bit block of data is to be transmitted between two multimedia terminals. Determine ratio of the propagation delay to the transmission delay, for the following types of data link:

- i. 150m of twisted-pair wire and a transmission rate of 10kpbs.
- ii. 05 km of coaxial cable and a transmission rate of 1Mpbs.
- iii. 36,786km satellite link and a transmission rate of 10Mpbs.

Assume that the velocity of propagation of an electrical signal within each type of cable is  $2 \times 10^8$  m/s, and that of free space  $3 \times 10^8$  m/s.

Q.4. (c) Draw block diagram for perceptual audio-coder architecture and explain the frequency analysis methodology.

Q.5. (a) A block of data is to be transmitted across a serial data link. If a clock of 19.2KHz is available at the receiver; deduce the suitable clock rate ratios and estimate the worst case deviations from the nominal bit cell centers, expressed as percentage of a bit period, for each of the following data transmission rates. (1) 1200 bps (2) 2400bps (3) 9600bps

Q.5. (b) A series of messages is to be transferred between two computers over a PSTN. Messages comprise just the characters A through H. An analysis has shown that the probability (relative frequency of occurrence) of each character is as follows: A & B = 0.1, C & D = 0.14, E, F, G & H = 0.055. (a) Use Shannon's formula to derive the minimum average number of bits per character. (b) Derive the average number of bits per character for your codeword set and compute this with: (i) the entropy of the messages (Shannon's variable length code words), (ii) fixed length binary code words, (iii) 7 bit ASCII code word.