FIRST DIET

Programme: B. Sc (Honours) Degree in Telecommunications Engineering

Session: 2011 – 12
Level: 3
Date: 04 June 2012

Semester: B
Duration: Three Hours
Max. Marks: 100

M3H620944: Telecommunications Applications-III

Candidates Should Attempt Four Full Questions choosing Two Full Questions from Section-A and Two Full Questions from Section-B

Please read the Questions carefully

Materials to be Supplied/Allowed:
Question paper (Supplied)
Blank Examination Script (Supplied)
Non-programmable calculator (Allowed)
Formulae sheet (Provided)
Section A (Answer any Two Full Questions)

Q1(a) Perform a detailed design of a Huffman Coding tree for the text message which has the following characters with relative probability as shown in the Table Q1(a) to accomplish the tasks stated below:

<table>
<thead>
<tr>
<th>Character</th>
<th>A</th>
<th>B</th>
<th>F</th>
<th>U</th>
<th>C</th>
<th>H</th>
<th>N</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probability</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

Table Q1(a)

i) Label the binary branches and obtain the Variable Length Code for all the characters.

ii) Using the coding tree generated, show the binary stream to construct the word ‘MUNCH’.

(b) Explain clearly the need of Zig-Zag scanning for image compression as envisioned in JPEG standard for fixed images.

(c) Illustrate the structure of Forward Error Correction deployed for the DVB-S standard with proper labeling.

Q2(a) Enumerate the merits and demerits of the Digitization of the video signals.

(b) Explain the importance of Lossy Source Coding and describe clearly how the Video compression methods and Audio compression methods are carried out to achieve lossy compression.

(c) Describe in detail the generation of the MPEG Transport Stream and Program Stream in terms of stream structure, packet size, purpose and media used with appropriate diagram.

Q3(a) Describe how the performance of Microwave tubes can be improved at Ultra-high frequencies.

(b) i) Explain in detail the Two-cavity Klystron amplifier with an appropriate schematic diagram and discuss the two main principles involved in it.

ii) Explain how the efficiency of the klystron amplifier can be further improved.
Q4(a) 'Multiple access techniques are widely used in the satellite systems.' Explain in detail how each Multiple access techniques are carried out. [9]

(b) Perform an analysis of the link from satellite earth station to a receiver, to estimate the carrier to noise ratio. Assume that the receiver has G/T of 30 dB at a distance of 36,000 km operating on 8 GHz frequency. The satellite is operating with a transmitter power of 50 watts and an antenna gain of 40 dBi for a bandwidth of 1 MHz. Assume losses between the satellite transmitter and its antenna is negligible. [10]

(c) Explain the importance of Medium Earth Orbit (MEO) satellites. [6]

Q5(a) Explain clearly the need of Doppler effect in Moving Target Indication RADAR System. [5]

(b) Describe the operation of a Moving Target Indication (MTI) RADAR System using Power Amplifier output with an appropriate block diagram. [10]

(c) Design a RADAR tracking system that operates at a wavelength of 0.05 m, with a maximum unambiguous range of 350 Km and target cross sectional area is 1 m². If the antenna diameter is 3.5 m and the receiver has a bandwidth of 1.8 MHz and a 10 dB noise figure. [10]

Q6(a) Discuss the various losses and its effects in optical cable that result in degradation of the optical signal. [8]

(b) A fiber-optic link extends for 50 km. The laser diode emitter has an output of 1.8 mW, and the receiver requires signal strength of -20 dBm for a satisfactory signal to noise ratio. The fiber is available in lengths of 2.5 km and can be spliced with a loss of 0.2 dB per splice. The fiber has a loss of 0.25dB/km. The total of all connector losses at the two ends is 3dB. Calculate the available system margin. [12]

(c) An optical fiber has a band-width distance product of 600 MHz-km and the maximum distance between the repeaters is 6 Km. Determine the bandwidth and the total dispersion. [5]

End of Question Paper
\[
\eta = \frac{\text{Average word length after coding}}{\text{Word length for pure binary coding}}
\]

\[
\frac{C}{N_0}(dB) = \text{EIRP}(dBW) - \text{FSL}(dB) - L_{\text{misc}} + G/T + 228.6 - 10 \log B
\]

\[
\text{FSL}(dB) = 32.44 + 20 \log d (Km) + 20 \log f (MHz)
\]

\[
\text{EIRP}(dBW) = P_T(dBW) + G_r(dBi) - \text{TFL}(dB)
\]

\[
\frac{C}{N_0}(dB) = \text{EIRP}(dBW) - \text{TPL}(dB) - \text{RFL}(dB) + \frac{G}{T} + 228.6
\]

\[
\text{TPL} = \text{FSL} + \text{AML} + \text{PL} + \text{AAL}
\]

\[
\frac{N_O}{C} = \left( \frac{N_O}{C} \right)_D + \left( \frac{N_O}{C} \right)_U
\]

\[
k = 1.38 \times 10^{-23} \text{ J/K; } T_O = 290K
\]

\[
r_{\text{max}} = \left( \frac{P_t S A_o^2}{4 \pi P_{\text{min}} \lambda^2} \right)^{1/4}
\]

\[
B = \frac{1}{2 \Delta t}
\]

\[
P_{\text{min}} = k T_O \delta f (F - 1)
\]

\[
A_o = \frac{0.65 \pi D^2}{4}
\]

\[
D_C(\lambda) = \left( \frac{SO}{4} \right) \left[ \lambda - \frac{\lambda_o^4}{\lambda^3} \right]
\]

\[
\Delta t = D_C(\lambda) \Delta \lambda \cdot I
\]

\[
m_{\text{ur}} = \frac{PRT(\mu s)}{12.2}
\]

\[
D = \frac{PW}{PRT} = \frac{\text{Average power}}{\text{Peak power}}
\]