

**Answer THREE Questions
(Calculators are Permitted)**

Question 1.

a) The local loop is always a major consideration when designing new applications for the home market. A forward looking telecommunications company wants to investigate the possibilities of transmitting high data rates over the local loop. You work for the 'smart ideas' group, and have been asked to provide a survey of the different transmission impairments on the local loop, specifically noting the most significant impairments for digital transmission. Suggest how the major impairment is normally overcome. [12 marks]

b) A digital signalling system has a channel bandwidth of 1000 Hz. If a signal element encodes an 8 bit word, what is the capacity of the channel? If a signal element encodes a 4 bit word, what has happened to the capacity of the channel? What can you deduce from this? [6 marks]

c) A new method of transmitting digital data over the local loop uses a technique known as inverse multiplexing to achieve high bit rates required. The available bandwidth of the copper (actually MHz) is split up into a number of equal bandwidth channels using Frequency Division Multiplexing techniques. Binary data is then transmitted into each channel using a multilevel modulation technique. At the receiver, the channels are then recombined to form a high speed transmission channel. Explain what you think is meant by Frequency Division Multiplexing. Look at the graph (Figure 1) which shows attenuation against frequency for copper. Extend your report to include your analysis of what happens to the data rate possible in each individual channel as frequency increases. If the characteristics of the local loop vary from one instance to the next, how might the technique be modified to take account of this? [9 marks]

d) It has been shown that the technique of inverse multiplexing can give data rates of upto 2 Mbps over the local loop in one direction, with a reduced rate in the reverse direction. Include in your report your analysis of the impact on a multimedia services to the home portfolio. [6 marks]

Question 2.

a) A small telecommunications company currently offers both data and voice services over a transmission system based on the Pleisiochronous Digital Hierarchy (PDH), and is feeling the threat of foreign competitors. Wanting to hang onto their business, the board of directors have asked you to write a 2 page report on the benefits/cost of changing to a transmission system based on the synchronous digital hierarchy (SDH). [13 marks]

b) Transferring from PDH to SDH has another potential in terms of a change in the switching aspects of the network. What switching technology would you recommend? Of particular importance are the advantages to be gained with respect to real-time multimedia facilities. [10 marks]

c) Conclude your report with an analysis of the impact of SDH and suitable switching technology on the revenue generation capabilities of the company. [10 marks]

Question 3

a) The company that you work for provides video telephony services over Basic Rate N-ISDN. You have been asked to write a Frequently Asked Questions (FAQ) page for the WWW site. You should include answers to the following questions:

- How does ISDN provide full-duplex communication over a single pair of twisted wires?
 - How does ISDN manage to transmit data at 144 kbps, when computer modems can only transmit at 30 kbps?
 - What is the difference in functionality of an ISDN connection compared to a normal voice line?
 - How many terminals can I connect to an ISDN line? and how many calls can I simultaneously make?
- [12 marks]

(Question 3 continues over the page)

(Question 3 Continued)

b) *The video-telephone will use compression for both audio and video. Suggest suitable division in the bit rate for audio and video communication, and specify how this would be mapped onto the ISDN BRA channels. What would be the benefits/disadvantages of using IP over the BRA channels?* [15 marks]

c) *ISDN BRA channels can potentially be switched over different routes in the wide area. If you are using IP over ISDN, what might be the impact on the video telephony service?* [6 marks]

Question 4.

a) *The company that you work for has decided to start using desk-top multimedia conferencing facilities on existing workstations and PCs. The existing local area network is a 10Mbps Ethernet that uses twisted pairs. The company wants to upgrade the network to provide higher speed connectivity, preferably again using Ethernet technology. Write a report detailing your recommendation for a cost effective solution. You should consider issues such as frequent staff moves within the building. Include in your report details of how high speed Ethernet uses twisted pairs to transmit at 100 Mbps, even though the maximum digital base-band transmission rate is 25 Mbps over twisted pairs.* [10 marks]

b) *Demonstrate that the standard Ethernet CSMA/CD protocol becomes unsuitable as the speed of the network increases from 10Mbps, to 50Mbps and then to 100 Mbps (assuming that the maximum length of the cable is 2500m, the propagation speed is 200m/micro second). Suggest a way of implementing collision detection in a high speed Ethernet.* [9 marks]

c) *Interactive multimedia communication often requires guarantees to meet Quality of service requirements. Evaluate the behaviour of an Ethernet for a range of different network loadings, in terms of parameters critical for interactive multimedia.* [14 marks]

Question 5.

a) *You work for a consulting company that specialises in voice processing solutions. The customer company to which you have been sent wants to provide voice mail facilities to its employees and wants you to evaluate the possible options they have been considering.*

The possible options for the company are:

- *a stand-alone answering machine for each desk from a local electronics retailer at 30 pounds per device*
- *a voice-mail service from the local telecommunications operator (1.25 pounds per employee per month)*
- *computer assisted telephony solution which requires the use of an existing PC with suitable gateway card, costing 1500 pounds all in, including software*

The company has an existing PBX system and feature phones for all employees. The company also has Internet access over 10Mbps Ethernets, and is quite well kitted out with a PC for each employee networked together using multiple Ethernet networks.

Write a report analysing the current facilities, and recommending a solution that is suitable for the medium term. Illustrate the economics of your decision assuming 100 employees in the company. [33 marks]

D51 Basic Communications DCNDS MSc Course