(Answer three questions out of five. Calculators are permitted.)

Question 1

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 128 kbps, when many computer modems can only transmit at 28.8 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?*

[18 marks]

b) The video-telephone will use compression for both audio and video. Suggest a 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]*

Question 2

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. *[13 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 data transmission rate of the channel? If a signal element encodes a 4-bit word, what has happened to the data transmission rate? What can you deduce from this? *[10 marks]*

c)Explain the principle of operation of an ADSL modem. Include in your answer a discussion of the impact of ADSL modems on web access levels. *[10 marks]*

Question 3

a) You work for a small company and your current job is to design and install an Internet e-mail system. One of the main tasks that faces you is the design of the naming scheme in the local domain. The options that you are considering are as follows:
- *national insurance number*
- *location code (similar idea to a post-code for paper mail)*
- *telephone number*
- *personal name*
- *employee ID*

Provide a report that recommends a suitable naming approach for your company, bearing in mind issues such as uniqueness, scalability, and ease of understanding. Further company-specific issues that you should consider are frequent staff moves within the company offices, the proliferation of lap-tops and other portable computers, name changes (when people get married and divorced). *[16 marks]*

b) Draw a pictorial representation of a multi-part e-mail message, that has some multimedia content, and a text message. Which protocol is responsible for constructing messages in this format? *[8 marks]*

c) If you were designing an e-mail to fax gateway, how would you implement such a gateway? *[9 marks]*

[END OF EXAM]

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. Also include in your report background information on CSMA/CD.   [13 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) Explain how gigabit Ethernet achieves a transmission rate of 1000Mbps over twisted pairs.   [11 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)
- a computer assisted telephony solution which requires the use of an existing PC with a 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 next 3 years. Illustrate the economics of your decision assuming 100 employees in the company.   [33 marks]

[END OF EXAM]

[END OF EXAM]