A1. Explain briefly the following terms:

a) Integrated Services Digital Network (ISDN) (5 marks)
b) Session Initiation Protocol (SIP) (5 marks)
c) Asymmetric Digital Subscriber Line (ADSL) (5 marks)
d) Asynchronous Transfer Mode (ATM) (5 marks)
e) ITU-T (formerly CCITT) (5 marks)

A2. This question is about IPv6.

a) Explain the terms global unicast address and link local address and the difference between them. (6 marks)

b) Explain the compressed format for writing IPv6 addresses and write the following IPv6 addresses in their shortest compressed form:

2001:0DB8:0000:1470:0000:0000:0000:0200 (4 marks)

F380:0000:0000:0123:4567:89AB:CDEF (3 marks)

c) Global unicast IPv6 addresses can be assigned dynamically in two different ways: stateless address autoconfiguration (SLAAC) and dynamic host configuration protocol v6 (DHCPv6). Describe the differences between the two methods. (12 marks)

A3. This question is concerned with local area networks using Ethernet technology.

a) Explain the difference between a switch and a bridge. (6 marks)

b) Briefly explain the difference between cut-through, fragment-free and store-and-forward switches. (9 marks)
c) Why are switches generally preferred to bridges except for the smallest networks? (6 marks)
d) How do routers operate differently from switches? (4 marks)

Section B

Answer Section B questions in Answer Book B

B4. This question is about the network layer and its functionality.
a) Briefly describe the concepts of: i) routing information, ii) routing algorithm and, iii) autonomous system, and indicate their involvement in the routing process. (8 marks)
b) There are three approaches to gathering and using routing information:
i. distance-vector routing,
ii. link-state routing,
iii. path-vector routing.
Briefly compare the three approaches by describing the routing information used and the way the routing algorithm works. (9 marks)
c) Describe the three main differences between RIPv1 and OSPF. (6 marks)
d) Summarise the difference between multicast and broadcast communication. (2 marks)

B5. This question is about the management of Quality of Service (QoS) in a network.
a) Briefly indicate two reasons why QoS management is required within an IP network. (4 marks)
b) The diagram below depicts the Integrated Services Architecture implemented in a router. Briefly indicate the function of at least two components (either from the foreground or background). (6 marks)

c) Describe FOUR key characteristics of the differentiated services mechanism for classifying and managing network traffic that contribute to its efficiency and ease of deployment. (8 marks)
d) Describe THREE IP metrics, defined by the IETF, that relate to the quality, performance and reliability of Internet data delivery. Which one is used to measure jitter? (7 marks)

B6. This question is about error detection and correction in data communication.

a) Consider the following example, transmitter A is transmitting character G (1110001) and using odd parity for error detection. Briefly explain what the transmitter will transmit and what the receiver will do to detect any error. (4 marks)

b) One of the most common error-detecting codes is Cyclic Redundancy Check (CRC).
   i. Briefly describes how CRC performs error-detecting. (4 marks)
   ii. Given the frame (message), generator and remainder shown below, what would be the transmitted frame? (3 marks)

   Frame:  1 1 0 1 0 1 1 1 1 1 1
   Generator:  1 0 0 1 1
               1 1 0 0 0 0 1 1 1 0 ← Quotient (thrown away)

   1 0 0 1 1/1 1 0 1 0 1 1 1 1 1 0 0 0 0 ← Frame with four zeros appended
   1 0 0 1 1
   1 0 0 1 1
   0 0 0 0 1
   0 0 0 0 0
   0 1 1 1 1
   0 0 0 0 0
   0 1 1 1 1
   1 0 0 1 1
   1 0 0 1 1
   1 0 0 1 1
   1 0 0 1 1
   1 0 1 1 0
   1 0 0 1 1
   1 0 0 1 1
   1 0 0 1 0
   1 0 0 1 1
   1 0 0 1 1
   1 0 0 1 0
   1 0 0 1 1
   0 0 0 0 0
   0 0 0 0 0
   0 0 0 0 0
   1 0 ← Remainder

   c) A 1024-bit message is sent that contains 992 data bits and 32 CRC bits. CRC is computed using the IEEE 802, standardized, 32-degree CRC polynomial. For each of the following, explain whether the errors during message transmission will be detected by the receiver:
   i. There was a single-bit error. (2 marks)
   ii. There were two isolated bit errors. (2 marks)
   iii. There were 18 isolated bit errors. (2 marks)
   iv. There was a 24-bit long burst error. (2 marks)
   v. There was a 35-bit long burst error. (2 marks)

d) Describe how Hamming Codes are used to perform error correction. (4 marks)