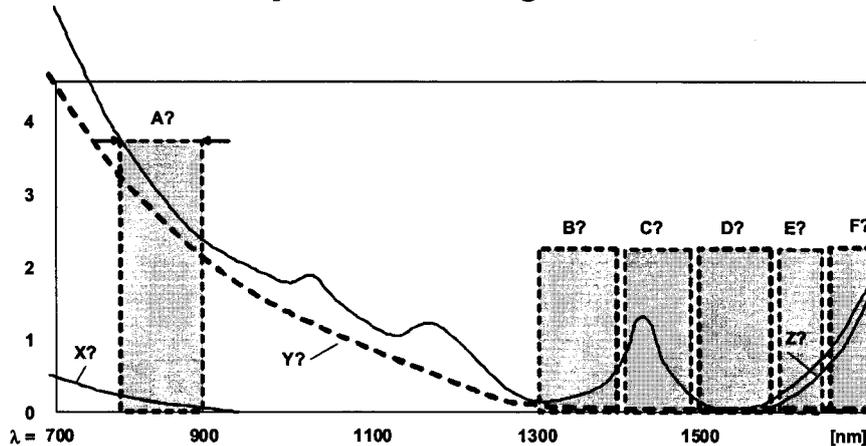- Please give short and readable answers.
- If not readable, the answer is wrong.
- List of subanswers is preferred over long and full sentences.

Question A1: Optical networking components

1. What types of optical fibers are used in optical communications?
2. Which are the traditional three windows out of A to F?
3. Give the advantage of usage for each of these three windows?
4. Which three physical effects (X to Z) shape the attenuation curve of the fiber?
5. Which nonlinear effects may occur in monomode fibers?
6. How to ensure that a cable break interrupts connectivity only for a short time?
7. How does an erbium-doped fiber amplifier (EDFA) operate?
8. Why interferometric structures are used for optical switches?
9. Give three implementation methods of an optical buffer.

Question A2: Electronic networking components

1. Highlight differences between basic (binary) CAMs and ternary CAMs.
2. Give the main system of static and dynamic random access memory (SRAM and DRAM).
3. Give the functional layering of a typical SONET/SDH framer device.

Question A3: Interconnects

1. Classify interconnects.
2. Describe an interface between asynchronous and synchronous digital circuits.
3. Describe SONET/SDH interfaces developed by the Optical Internetworking Forum.
4. Characterize the interfaces of 40 Gigabit and 100 Gigabit Ethernet systems.
5. What are the differences between the four levels of the UTOPIA interface?

Question A4: Systems

1. Give six different categories of network processor kernels.
2. What are the main requirements on performance of network processors?
3. Which technologies can be used to implement high-capacity backplanes?
4. What coding scheme is used in 10GBASE-R?
5. Give the main benefits and disadvantages of Storage Area Networks (SANs).
6. What is the difference between transparent SAN and IP-SAN?

Question B1: Networking

What is the difference between:
1. Isochronous, synchronous, and asynchronous connections?
2. Synchronization of network elements in PDH, SDH, and OTN?
3. Quality-of-Service (QoS), Class-of-Service (CoS) and Grade-of-Service (GoS)?
4. Operation of soft-state routing tables and that of hard-state switching tables?
5. Message switching, packet switching, frame switching, and cell switching?
6. Addressing in IP/Ethernet data units and that of FR, X.25, ATM and MPLS?
7. Ring protection by wrapping and that by steering?
8. Leaky bucket and token bucket?
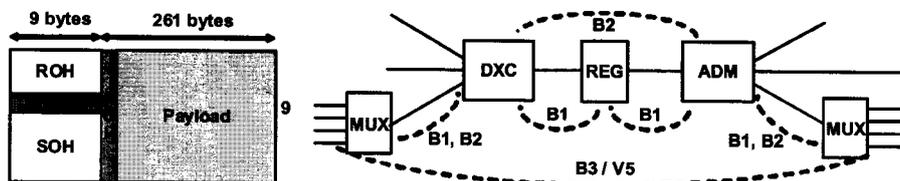
Question B2: Circuit-switching

1. What is the purpose of the B-bytes in SDH and where are B1, B2, B3 and V5 located in the transmission frame?
2. Which procedure maps packets onto SDH transmission channels?
3. What are the synchronization differences in PDH, SDH, and OTH?
4. What are the packet flow properties over a circuit-switched tunnel?
5. What does virtual concatenation mean in transmission switching?
6. What are the properties of transparent optical networks?

Question B3: Packet-switching

1. What is the mechanism to find the ATM cell-boundaries?
2. What is the difference in ATM cell size on the media and in the processing part?
3. What is inverse multiplexing? Give two technology examples
4. Which two addressing methods exist to transfer packets through the network?
5. What are the two advantages of link aggregation in Ethernet?

Question B4: Wireless access

1. Which is the transmission duplex mode in WLAN and DECT, respectively?
2. Which radio transmission structures are respectively used in GSM, GPRS, UMTS, HSPA, LTE and DECT?
3. How are contiguous user data bits principally send over the radio interface?
4. Give three categories (not systems!) of wireless media that requires a MAC.

Question B5: Wired access

1. Which transmission principle and which data formating structure is used in ADSL?
2. What is the difference between an access link in PSTN and ISDN?
3. Which duplex mechanisms can be used on a twisted copper-pair?
4. What are the transmission characteristics of powerline?
5. Which access technology uses the standard DOCSIS?