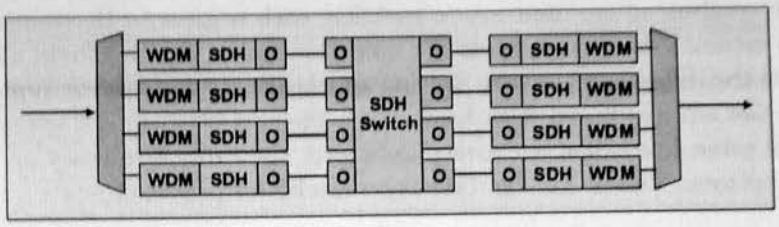
- **Please give short and readable answers.**
- **If not readable, the answer is wrong.**
- **List of subanswers is preferred over long and full sentences.**



Question A1: Optical networking components

1. How does an acousto-optic filter for multiple wavelengths work?
2. Where we use (figure) Fabry-Perot lasers and where distributed feedback lasers?
3. Which linear and nonlinear effects exist in monomode fibers?
4. Give the structure of a fiber cable (not the single fiber structure).
5. How fibers can be accessed at regular distances in a long-distance fiber cable?
6. Which differences exist been multimode optical fiber and POF communications?
7. What are the transmission characteristics of CWDM?

Question A2: Electronic networking components

1. Highlight differences exist between basic (binary) CAMs and ternary CAMs.
2. In which way a TCAM is used in IP networking?
3. Give the functional layering of a typical SONET/SDH framer device.
4. How to ensure that a cable break interrupts connectivity only for a short time?
5. Which technologies and semiconductor materials are used in telecom ICs?

Question A3: Interconnects

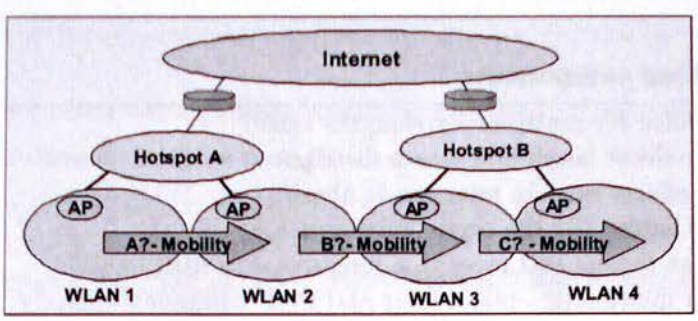
1. Characterize the components in an WDM opague crossconnect.
2. Classify interconnects.
3. Give the CSIX level functions of the physical, interconnection, and logical message.
4. Characterize the interfaces of 40 Gigabit and 100 Gigabit Ethernet systems.
5. What are the main differences between the four levels of the UTOPIA interface?

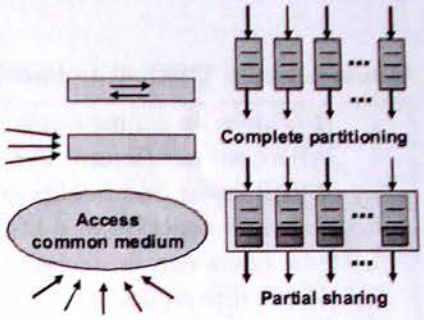
Question A4: Systems

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 components can be used in FC systems?
5. What is the difference between transparent SAN and IP-SAN?

Question B1: Networking

1. Explain quality-of-service (QoS), class-of-service (CoS) and grade-of-service (GoS).
2. What are soft-state tables and how to operate hard-state tables?
3. How to combine micro- and macro-mobility with respect to IP addressing?
4. Which medium-sharing methods are used for duplex, multiplexing, and access?
5. What is the difference between routing protocols and forwarding protocols?
6. Which two address-based data-forwarding schemes between end systems exist?
7. Give all seven functional network planes with the cable/frequency-spectrum plane at the bottom. This is not the OSI layer model for protocols.





Question B2: Circuit-switching

1. In which manner the quality of SDH transmission links are monitored?
2. What does virtual concatenation mean in transmission switching?
3. Which procedure maps packets onto SDH transmission channels?
4. What are the synchronization differences in PDH, SDH, and OTH?
5. What are the packet flow properties over a circuit-switched tunnel?
6. What are the properties of transparent optical networks?

Question B3: Packet-switching

1. In which manner the quality of carrier Ethernet transmission link are monitored?
2. For what purpose a 64-bit IEEE address has been created? What is its structure?
3. Which four end-to-end transport protocols exist and give their main properties?
4. Give the advantage of partial shared buffers among multiple output links.
5. Which user signaling protocol is used in IP networks?
6. Which effect has active queue management in routers on passing TCP connections?

Question B4: Wireless access

1. Give the difference between the transmission duplex mode in WLAN and WiMax.
2. Explain why in GSM/GRPRS two multiframe-structure sizes, 51 and 52, exist.
3. In which sequence are contiguous user data bits sent over the radio interface?
4. Which timing criteria are used to coordinate radio access in IEEE WLANs?
5. In which way are logical channels respectively organized in GSM, UMTS and LTE?

Question B5: Wired access

1. Why telephone modems with high signal processing still have a modest data rate?
2. What is the user signalling difference between an access link in PSTN and ISDN?
3. Which access topologies can be used for dual-homing protection?
4. What are the functionalities of a DSLAM?
5. Why we need a transcoder and rate adapter unit for GSM circuit-switched access?
6. Which functionality is required in an unit for GSM voice-packet access?