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Answers Key:

Long Answer Type Questions

1. 5G has the ability to significantly impact society by enabling faster, more reliable communication and Supporting a wide range of new technologies. Main areas of impact include:
   • **Enhanced Connectivity** 5G offers faster data speeds and lower latency, improving internet access and connectivity for smart cities, IoT devices, and remote areas.
   • **Healthcare** Remote surgeries, telemedicine, and real-time patient monitoring can be easily done with 5G, improving healthcare delivery and outcomes.
   • **Industry and Automation** 5G will accelerate industry 4.0 by enabling more advanced automation, real-time monitoring, and the use of Al in manufacturing, logistics, and supply chains.
   • **Entertainment and Media** 5G will enable higher-quality streaming, VR, and AR experiences, transforming gaming, education and other industries.
   • **Transportation** Autonomous vehicles and smart traffic systems will benefit from 5G's high-speed communication, improving safety and reducing congestion.
2. IP address different from MAC address are as follows

IP Address	MAC Address
An IP address is a logical address used for routing data packets between networks.	A MAC address is a physical address assigned by the device manufacturer for local network communication.
It is assigned by a network administrator and changes with each network Connection.	It is unique and permanent identifier, remaining static across networks.
An IP address is typically 32 bits (IPv4) or 128 bits (IPv6) in length.	A MAC address is 48 bits (6 bytes) in length and represented in hexadecimal format.
IP addresses function at the network layer.	MAC address operate at the data-link layer.

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Short Answer Type Questions

3. Yes, mobile phones have a MAC (Media Access Control) address, but it's not directly related to the IMEI (International Mobile Equipment Identity) number. MAC address, typically represented by 12-digit hexadecimal code (e.g., 00:11:22:33:44:55) and is used for device authentication and security within local networks.
   In contrast, the IMEI is a 15-digit numerical identifier (e.g., 987892365389002) that uniquely identifies the device at an international level and is tied to its hardware.
4. Ina network, various types of senders(or devices that transmit data) include:
   • Computers (PCs, Laptops) Common devices that send data packets over a network to other devices Or servers.
   • Servers Sends the data to clients in client-server models, such as web servers or database servers.
   • Mobile Devices Smartphones and tablets that send the data through Wi-Fi or cellular networks.
   • IoT Devices Sensors and smart devices that send the data continuously, often in small packets.
   • Routers and Switches It sends routing information and forward data packets between network segments.
   • Printers/Scanners Network-enabled printers or Scanners that send data to devices like computers.
5. The two main advantages of using a network of computing devices are as following:
   1. Network of computing devices enhanced collaboration and communication, it enables:
   • Real-time data sharing and synchronization.
   • Video conferencing and online meetings.
   • Instant messaging and email.
   • Collaborative work on projects and documents.
   2. Network of computing devices increased flexibility and scalability as a result:
   • Easy to add new devices and users.
   • Network architecture can be modified or expanded as needed.
   • Network architecture can grow or shrink as organization needs change.
   • Users can easily access network resources from anywhere, at any time.
6. A MAC (Media Access Control) address is a unique identifier assigned to network devices, ensuring accurate data transmission and network security. MAC addresses prevent data misrouting, enable secure communication, and simplify troubleshooting. They are essential for various network technologies, including Ethernet, Wi-Fi, and Bluetooth.

7.

Basis	Wired Media	Wireless Media
Transmission Medium	Uses physical cables like twisted pair, coaxial, or fiber optic.	Uses electromagnetic waves for data transmission.
Speed and Reliability	Faster and more reliable.	Comparatively slower and affected by interference.
Mobility	Limited mobility due to cables.	Provides high mobility and flexibility.
Installation Cost	Costly and difficult to install over long distances.	Easier and cheaper to set up in large arears.

8. **(a) Bandwidth** It refers to the maximum amount of data that can be transmitted Over a communication channel in a given period of time. It is measured in Hertz (Hz) - the difference between the highest and lowest frequencies in a signal.
(b) Data Transfer Rate It is the speed at which data is transmitted from one device to another. It indicates how quickly information can move across a network or connection and is also measured in bps, Kbps, Mbps, or Gbps.
(c) Bluetooth It is a short-range wireless communication technology used to connect devices like mobile phones, laptops, and headphones. It operates in the 2.4 GHz frequency range and allows data exchange within a range of about 10 meters.
9. A protocol in data communication is a set of rules and standards that define how data is transmitted, received, and interpreted between devices in a network. It ensures that devices from different manufacturers can communicate correctly and efficiently.
Example
The HTTP (HyperText Transfer Protocol) is used for communication between a web browser and a web server. When you open a website, your browser uses HTTP to request the webpage, and the server responds using the same protocol to send the data back.
10. Highest frequency (fH) = 1 GHz
= 1000 MHz
Lowest frequency (fL) = 500 MHz
Bandwidth (BW) = fH- fL
= 1000 MHz – 500 MHz
= 500 MHz
So, the bandwidth of the signal is: 500 MHz or 0.5 GHz.
11. Differences between wired and wireless transmission are as follows:

Wired Transmission	Wireless Transmission
These are also called guided media.	These are also called unguided media.
In this media, the computers in a network are connected using wire or cable.	In this media, the computers in a network are connected using waves.

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12. Twisting the cables keeps them close together so that any external magnetic fields must cross both cable at the same time, so the interference created in one cable is cancelled by an almost equal and opposite amount of interference in the other cable.
13. **Low power** Because signals in optical fibres degrade less, lower power transmitters can be used.
Higher data rate Due to higher bandwidth, data rate of optical fibre is more than the data rate of ethernet cable (upto 1Gbps).
14. A protocol is a set of rules that two or more computers must follow to communicate on a network. FTP (File Transfer Protocol) is used to copy a file from/to a remotely located server.
15. (a) (i) IP - Internet protocol
(ii) TCP- Transmission Control Protocol
(b) Protocol allows connected devices communicate with each other regardless of any differences in their internal processes, structure or design.
16. Wired → Optical fibre
Wireless → Microwave
17. SMTP stands for Simple Mail Transfer Protocol.
SMTP is used for sending emails from one computer or mail server to another. It handles the outgoing mail-transfering messages from the sender's email client (like Outlook or Gmail) to the recipient's mail server.
18. VoIP is a technology that allows people to make voice calls using the internet instead of a traditional telephone line. Applications like skype, whatsApp, Zoom and google meet use VoIP.
19. The differences between Packet Switching and Circuit Switching are as follows:

Packet Switching	Circuit Switching
Data is broken into packets and transmitted independently.	A dedicated communication path is established for the entire duration of the call.
More efficient for bursty data traffic, as the network resources are shared.	Less efficient, as the dedicated path remains unused if no data is being sent.
Connection is established as needed, with no constant connection required.	A fixed, continuous connection is maintained throughout the session.
Suitable for data, email, and internet traffic.	Suitable for voice calls and video conferences.
Example The internet, where packets are routed based on the current network conditions.	**Example** Traditional telephone networks.

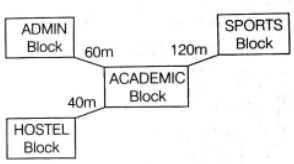
20. Wireless technology is also known. as unguided media. This media does not use any wires or cable for its connectivity in the network. It uses electromagnetic waves. Some of the wireless technologies are:
(i) Bluetooth
(ii) Radiowave
(iii) Infrared
(iv) Microwave
(v) Satellite communication
(a) Bluetooth It is used for exchanging data over a short distance from fixed and mobile devices. This type of media comes under PAN (Personal Area Network).
(b) Radiowave When two terminals are connected by using radio frequencies, then such type of communication is known as radiowave transmission. Radiowave transmission set-up has two parts.
- **Transmitter Devices,** which transmit signals are termed as transmitter.
- **Receiver Devices,** which receive signals are known as receiver.

Case Study Questions

21. (i) (C) Overcrowding of the wireless channel or interference from other devices.
(ii) (B) The upload speed provided by their internet service plan.
(iii) (C) SMTP
(iv) (C) The signal strength of the wireless network weakens with distance.
(v) (C) To facilitate communication between the computers on the local network and provide access to the internet.

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22. (i) ACADEMIC block
Justification
- It has the maximum number of computers (600)
- Most data traffic will originate from here
- Reduces network congestion and improves efficiency
(ii)



(iii) Two wired media
- Twisted Pair Cable
- Optical Fiber Cable
(iv) (A) Radio Waves
(v) (a) VoIP (Voice over Internet Protocol)
Or (b) Install repeater between:
ADMIN ↔ HOSTEL (160 m) or
HOSTEL ↔ SPORTS(150 m)
Justification
- These distances are longest
- Signal may weaken over long distances
- Repeater boosts signal strength