



CHAPTER-8

APPLICATIONS OF COMPUTER SCIENCE

Introduction:

In this chapter, students will explore the applications of computer science through emerging technologies. They will learn about Artificial Intelligence (AI) and its use in everyday applications such as voice assistants, chatbots, and image recognition, along with its benefits and challenges. The chapter introduces the Internet of Things (IoT) and how connected devices collect and share data for automation.

8.1 Understanding Emerging Technologies

Q. What are Emerging Technologies? Explain their importance in today's digital age.

Emerging Technologies

Emerging technologies refer to advanced innovations that are transforming how people live, work, and communicate. Emerging technologies are new and advanced technologies that improve different areas of life. They help people work faster, communicate better, and manage information more easily.

Short Question
What are Emerging Technologies?

Technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), Cloud Computing, and Blockchain are examples of emerging technologies.

These technologies are changing many industries by creating smarter systems for data management, automation, and connectivity. They are widely used in healthcare, education, transportation, and agriculture. They make work faster, easier, and more efficient.

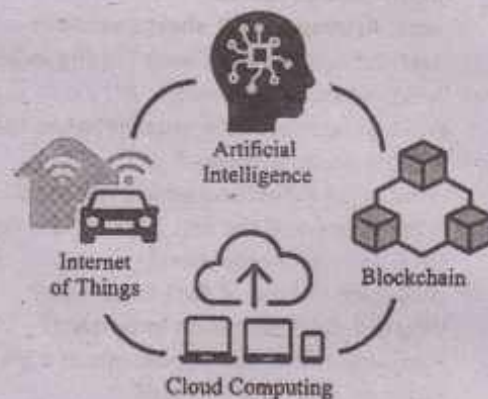
Importance of Emerging Technologies

Understanding emerging technologies is important in today's digital age.

- They provide new solutions to many local and global challenges.
- They also improve the quality of different services and support innovation.
- At the same time, these technologies bring challenges such as data security, ethical concerns, and dependence on automation.
- Learning about emerging technologies helps people understand their benefits and challenges. It also prepares them to use these technologies responsibly in the future.

Example

A hospital uses Artificial Intelligence (AI) to help doctors detect diseases quickly. This saves time and helps doctors provide better treatment to patients.



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- Emerging technologies like AI, IoT, Cloud Computing, and Blockchain are shaping the next digital revolution, connecting people, data, and devices across the world.

Ex.Q.2. What is Artificial Intelligence (AI)? Discuss the benefits and challenges of Artificial Intelligence (AI) in society. How can ethical principles ensure fair and responsible use of AI?

Artificial Intelligence (AI)

Artificial Intelligence (AI) is a branch of computer science that enables machines to perform tasks that typically require human intelligence. It allows computers to analyze data, recognize patterns, and make decisions with minimal human input.

AI systems learn from experience through a process called machine learning. In this process, algorithms are trained using large amounts of data. As the system processes more data, its performance becomes more accurate.

AI works by combining data, algorithms, and computing power. It can understand speech, detect objects in images, and predict outcomes.

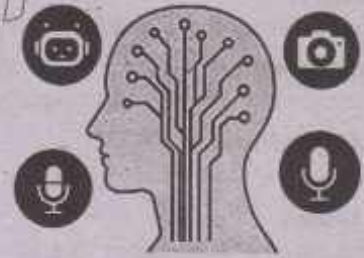


Figure 8.2: Artificial Intelligence systems mimic human intelligence to perform tasks like vision, speech, and decision-making

AI uses technologies such as Neural Networks (NN) and Natural Language Processing (NLP) to process information in a way that is similar to the human brain. This allows AI to solve complex problems, automate tasks, and work with large amounts of information.

- **Neural Networks (NN):** AI models that learn from data by working like the human brain.
- **Natural Language Processing (NLP):** AI technology that enables computers to understand and process human language.

Common AI Applications

Voice Assistants

Voice assistants such as Siri, Alexa, and Google Assistant understand spoken commands and provide useful responses.

Chatbots

Chatbots on websites answer customers' questions automatically.

Image Recognition

Image recognition systems identify faces, objects, and medical conditions from images and scans.

Recommendation Systems

Recommendation systems on platforms such as YouTube, Daraz, and Amazon suggest videos and products based on users' interests.

Self-Driving Cars

Self-driving cars use AI to understand their surroundings and make safe driving decisions.

These applications make technology more interactive, efficient, and useful.

Benefits of AI in Society

Faster and More Accurate Work

AI improves efficiency, accuracy, and convenience. It performs repetitive tasks faster than humans.

Healthcare

AI helps doctors detect diseases and supports farmers in monitoring crops.

For example, DeepMind's AI analyzes 3D eye scans and helps predict eye diseases such as glaucoma before clear symptoms appear.

Business

Companies such as Amazon and Daraz use AI chatbots to answer customers' questions, such as "Where is my order?", for thousands of users at the same time.

Businesses also use AI to study customer behavior, predict market trends, and improve decision-making.

Education

AI supports education by providing personalized learning and adaptive tutoring systems.

Challenges of AI in Society

AI provides many benefits, but it also creates some challenges.

Data Privacy:

AI systems collect and use large amounts of data. Personal information may be at risk if it is not protected properly.

Job Displacement

AI can perform many tasks automatically. This may reduce the need for some jobs and affect workers.

Bias in AI Algorithms

AI may produce unfair results if it is trained on biased data. This can lead to unfair decisions.

Ethical Issues

AI systems may make decisions that affect people's lives. These decisions should be fair, responsible, and ethical.

Responsible Use of AI

AI should be used fairly and responsibly. Ethical use of AI helps ensure that it benefits society.



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- Farmers use AI with drones and sensors to monitor crops, helping them increase yield and reduce waste.

EX.Q.3 Describe how IoT devices collect and communicate data for automation. How is IoT improving sectors such as healthcare, agriculture, and smart homes?

Internet of Things (IoT)

The Internet of Things (IoT) refers to a network of physical devices connected through the Internet that can collect, share, and act on data. These devices often include sensors, processors, and communication hardware, allowing them to work together intelligently.

IoT connects everyday devices such as lights, thermostats, and home appliances. These devices can be monitored and controlled remotely. This improves efficiency, convenience, and real-time decision-making in homes and industries.

IoT systems use wireless communication technologies such as Wi-Fi, Bluetooth, and cellular networks. Connected devices communicate with each other or with a central platform to exchange information automatically. This creates a smart environment where devices work with very little human effort.

Example

A smart home uses IoT devices to control lights, curtains, and the thermostat. The lights turn on automatically in the evening, the curtains open in the morning, and the thermostat adjusts the room temperature without human intervention.

Short Question

What is Internet of Things (IoT)?

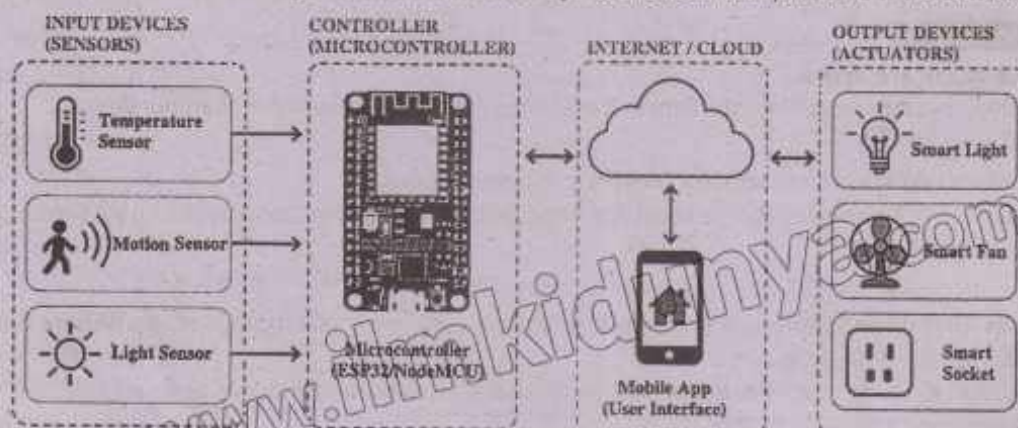


Figure 8.3: Smart Home using IoT: Connected devices such as lights, thermostat, and security systems can be monitored and controlled remotely through the Internet.

Data Collection, Communication, and Automation

Data Collection

Sensors collect data from the environment, such as temperature, movement, and humidity.

Communication

The collected data is sent to cloud-based systems or servers for processing and analysis. Devices communicate with each other to keep the system synchronized.

Automation

After analyzing the data, the system performs actions automatically. For example, lights turn off when no one is in a room, or the irrigation system starts when the soil becomes dry. Automation reduces manual work, saves time, and minimizes human error. It helps create smarter, safer, and more efficient homes, industries, and communities.

Applications of IoT

Smart Homes

IoT allows people to control lights, heating systems, curtains, and security systems through mobile apps or voice commands.

For example, smart LED bulbs can be turned on or off using a smartphone. They can also be set to turn on automatically at a specific time. Smart curtains can open automatically with the morning alarm and close when the room temperature rises above 35°C.

Short Question

How does IoT make homes smarter and more convenient?

A smart thermostat adjusts the room temperature according to the user's preferences. Security cameras can send alerts directly to a smartphone. These systems improve comfort, save energy, and increase home security.

Healthcare

IoT sensors monitor patients' heart rate, blood pressure, and glucose levels in real time. Doctors can monitor patients remotely and respond quickly during emergencies.

Agriculture

IoT devices measure soil moisture, temperature, and weather conditions. This helps farmers improve irrigation, manage crops, increase production, and reduce waste.

? DO YOU KNOW?

- The IoT connects everyday devices like fridges, cars, and lights so they can "talk" to each other automatically.

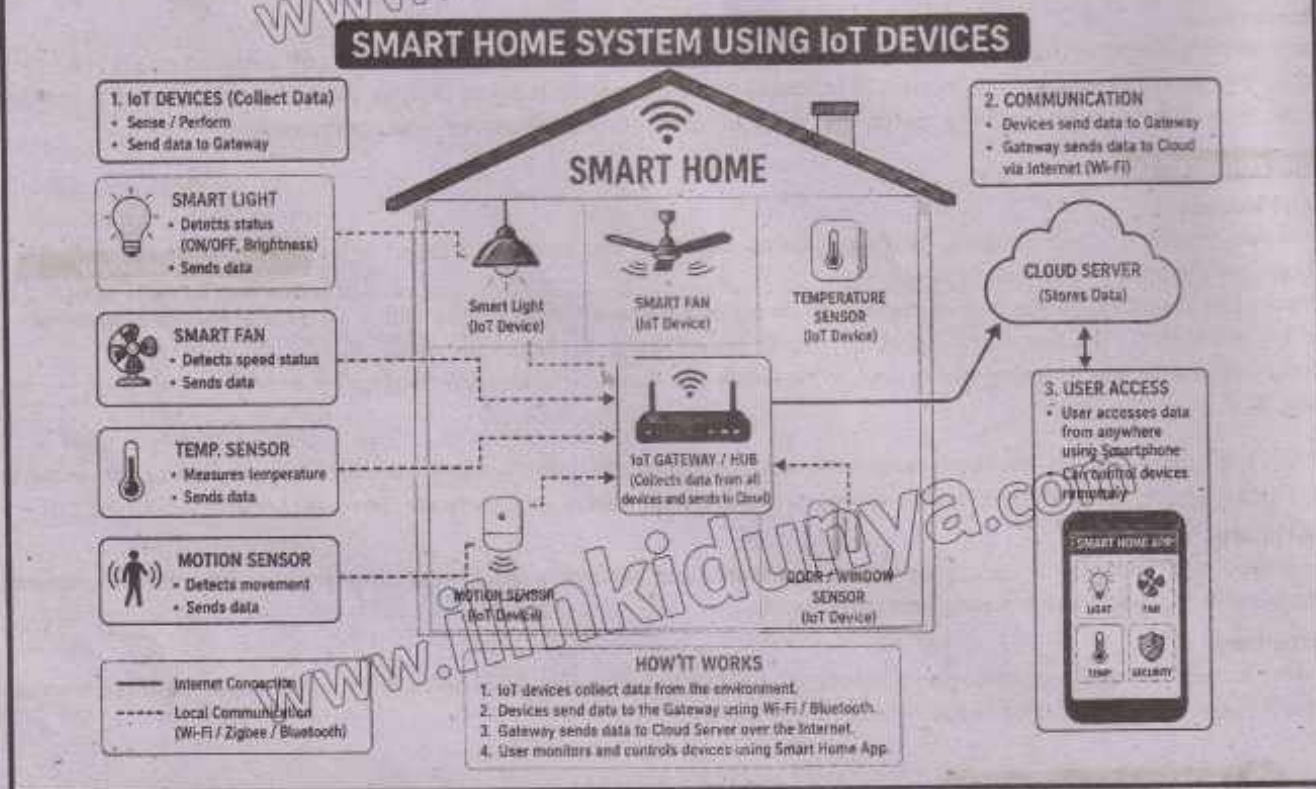
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- Smart homes, wearable fitness bands, and smart farms are all powered by IoT technology.



CLASS ACTIVITY

Sketch a smart home system that uses IoT devices (lights, fans, sensors). Label how each device collects and communicates data.



Additional Multiple Choice Questions

- Advanced innovations that are transforming how people live, work, and communicate called:
 - A) Emerging technologies
 - B) Data technologies
 - C) Networking technologies
 - D) Innovations technologies
- A branch of computer science that enables machines to perform tasks that typically require human intelligence is:
 - A) Data mining
 - B) Networking
 - C) Programming
 - D) Artificial Intelligence (AI)
- AI systems learn from experience through a process called:
 - A) Data mining
 - B) Networking
 - C) Machine learning
 - D) Programming
- Which AI application automatically answers customers' questions on websites?
 - A) Image recognition
 - B) Recommendation systems
 - C) Self-driving cars
 - D) Chatbots
- Which of the following is a challenge of AI in society?
 - A) Personalized learning
 - B) Better decision-making
 - C) Bias in algorithms
 - D) Faster and more accurate work
- A network of physical devices connected through the Internet called:
 - A) Telephone network
 - B) Physical Network
 - C) Network of Things
 - D) Internet of Things
- IoT devices often include:
 - A) Printers and scanners
 - B) Keyboards and mice

- C) Monitors and speakers D) Sensors, processors, and communication hardware
8. After analyzing the data, the IoT system performs actions:
A) Automatically B) Manually C) Offline D) Slowly
9. Which of the following is an example of an emerging technology?
A) Keyboard B) Printer C) Cloud Computing D) Scanner
10. Why is understanding emerging technologies important?
A) They remove the need for education.
B) They eliminate all security risks.
C) They completely replace human thinking.
D) They prepare people to use these technologies responsibly in the future.

Answers:

1	A	2	D	3	C	4	D	5	C	6	D	7	D	8	A	9	C	10	D
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Cloud Computing

Ex.Q.4 What is Cloud Computing? Explain how Cloud Computing supports scalability, accessibility, and collaboration. Compare different cloud platforms like Google Drive, AWS, and Microsoft Azure.

Cloud Computing

Cloud computing is a technology that allows users to store, manage, and process data on remote servers instead of local computers. These servers are hosted on the internet and managed by cloud service providers. This means users can access their data and applications anytime, from anywhere, using an internet connection.

Cloud computing removes the need for powerful personal computers because most of the processing is done on remote servers. It also allows individuals and businesses to use online services such as data storage, web hosting, and software applications without maintaining physical hardware.

Cloud computing supports many modern digital services, including streaming platforms, online learning systems, and collaborative workspaces. It makes computing more flexible and connected.

Example

A student saves assignments on Google Drive. The files are stored on cloud servers and can be accessed from a computer or mobile phone using the internet. This is an example of cloud computing.

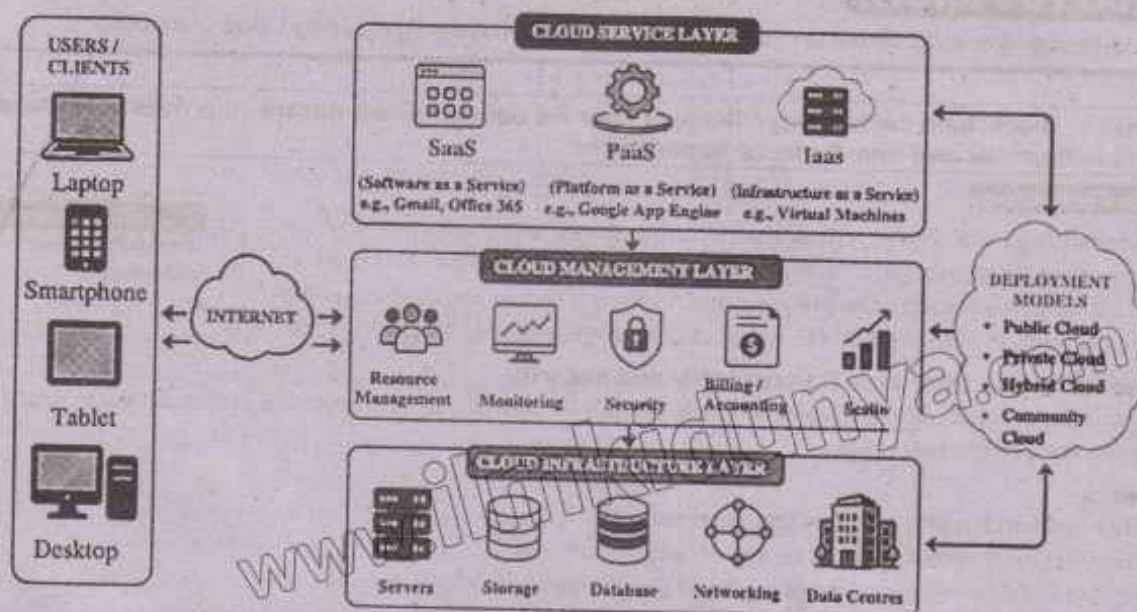


Figure 8.4: Cloud Computing enables users to store, access, and share data from anywhere through the internet.

Advantages of Cloud Computing

Scalability

Cloud computing allows users to increase or decrease storage space and computing power according to their needs. This is useful for growing businesses and organizations. It provides flexibility without the need to buy new hardware. This makes it easier to handle changes in workload.

Short Question
What is scalability in Cloud Computing?

Accessibility

Cloud services allow users to access their data and applications from different devices and locations. Files do not need to be transferred manually. Users only need an internet connection to access their data. This allows people to work anytime and from anywhere.

Short Question
What is accessibility in Cloud Computing?

Cost Effectiveness

Cloud computing reduces the need for expensive servers and maintenance. Users usually pay only for the services they use through a pay-as-you-go model. This helps reduce operating costs. It also reduces spending on hardware and software upgrades. This makes cloud computing a cost-effective solution for individuals and businesses.

Examples of Cloud Computing

Google Drive

A cloud storage service used to store, access, share files, and collaborate on documents online.

Amazon Web Services (AWS)

A cloud computing platform that provides services such as web hosting, data storage, and application development for businesses.

Microsoft Azure

A cloud computing platform that allows developers to build, manage, and run applications through the cloud.

Comparison:

- Google Drive is mainly used for file storage and sharing.
- AWS is mainly used for cloud computing services, web hosting, and application development.
- Microsoft Azure is mainly used to build, deploy, and manage applications in the cloud.

? DO YOU KNOW?

- When you save a document on Google Drive or iCloud, you're actually using Cloud Computing.

Ex.Q.5 What is Blockchain technology? Discuss how its decentralized nature improves transparency and security in financial and non-financial applications.

Blockchain Technology

Blockchain technology is a digital system that securely stores and shares information across many computers instead of a single central server. Information is stored in blocks, and each block is linked to the previous one, forming a secure and unchangeable chain. Every transaction is verified by the network before it is added to the blockchain.

Short Question
What is Blockchain technology?

How Decentralization Improves Transparency and Security

Blockchain is decentralized, which means no single person or organization controls the entire network. Every computer (node) keeps a copy of the blockchain.

Transparency

- All authorized participants can view the same records.
- Every transaction is recorded and can be verified.
- Changes are visible to all users, reducing fraud and increasing trust.

Security

- Data is stored on many computers instead of one central server.
- A hacker cannot easily change the records because all copies must match.
- Once data is added to the blockchain, it cannot be changed or deleted easily.
- Cryptography protects the data from unauthorized access.

Financial Applications

- Used in cryptocurrencies such as Bitcoin.
- Enables secure peer-to-peer money transfers without banks.
- Reduces transaction costs and processing time.
- Prevents fraud by keeping a permanent record of transactions.

Non-Financial Applications

- **Supply Chain Management:** Tracks products from manufacturer to customer and verifies authenticity.
- **Healthcare:** Stores medical records securely and prevents unauthorized changes.
- **Government:** Manages land records and public documents securely.
- **Education:** Stores and verifies academic certificates and degrees.
- **Business:** Improves transparency and efficiency in managing records and transactions.



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- From cryptocurrency to supply chain tracking, blockchain builds trust through transparency.



Additional Multiple Choice Questions

- Cloud computing is a technology that allows users to store, manage, and process data on:
A) Local computers B) USB drives C) Remote servers D) Hard disks
- Cloud computing allows users to access their data and applications:
A) Only at home B) using internet connection
C) Without the internet D) Only from one computer
- Which of the following is an advantage of cloud computing?
A) Scalability B) Virus attack C) Data loss D) Hardware failure
- In cloud computing, users usually pay only for the services they use through a:
A) Monthly salary B) Fixed license C) Free account D) Pay-as-you-go model
- Which of the following is a cloud storage service that allows users to store, access, and share files over the internet?
A) Microsoft Word B) Google Drive C) Notepad D) Paint
- Blockchain technology is a digital system that securely stores and shares information across:
A) One central server B) Local computers only C) Many computers D) Mobile phones only
- Which feature of blockchain improves transparency, security, and trust?
A) Centralized structure B) Decentralized structure C) Manual processing D) Offline storage
- Blockchain is used in finance to support cryptocurrencies such as:
A) Ethereum IDE B) Google Pay C) PayPal D) Bitcoin
- Which blockchain application tracks goods from their origin to the customer?
A) Data Security B) Finance C) Supply Chain Management D) Education
- Which statement about blockchain is correct?
A) It allows direct exchange of information without intermediaries.
B) It stores all data on a single central server.
C) It requires information to be changed regularly.
D) It works only in financial institutions.

Answers:

- | | | | | | | | | | | | | | | | | | | | |
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8.2 Cultural and Ethical Implications of AI Systems

Q. Describe the cultural and ethical implications of AI systems. Also describe the stakeholders in AI systems and the importance of cultural awareness and diversity.

Cultural and Ethical Implications of AI Systems

The cultural and ethical implications of AI systems refer to the effects of Artificial Intelligence on people, society, and different cultures. Artificial Intelligence (AI) affects the way people live, work, and use technology. AI systems are not only technical tools but also social tools that influence individuals, communities, and governments. Therefore, it is important to consider their cultural and ethical effects.



Figure 8.5: Ethical AI Design Balances the Interest of Different Stakeholders While Ensuring Fairness and Inclusivity.

Stakeholders in AI Systems

AI systems involve different stakeholders. Each stakeholder has an important role in developing, using, and managing AI systems.

Developers

Developers design and build AI systems. They focus on functionality, innovation, and performance. They also ensure that AI systems are accurate, fair, and ethically developed.

Users

Users interact with AI systems in their daily activities. They expect AI systems to be easy to use, reliable, and accurate. They are also concerned about privacy and security.

Governments

Governments create laws and policies for the safe and fair use of AI. They protect public interests and ensure that AI systems follow legal requirements.

Communities

Communities help protect social values and cultural traditions. They encourage the responsible and ethical use of AI in society.

Cultural Awareness and Diversity

Cultural diversity affects how AI systems are designed and used in different parts of the world. Cultural values influence people's expectations about privacy, communication, and the use of technology.

AI developers should consider local traditions and social behavior when designing AI systems. This makes AI more useful and respectful for different cultures.

Privacy preferences are different in different regions. Some societies are comfortable with sharing data, while others expect strong privacy protection. Language models should support different languages and dialects to avoid cultural bias. AI systems should also respect local customs and social values to ensure fairness and acceptance.

Example

A voice assistant that supports different languages and respects local cultural values can be used easily by people from different countries. This makes the AI system more useful and fair for everyone.



CLASS ACTIVITY

Debate: "Should AI make decisions that affect people's lives, such as job hiring or grading students?"

Sol: *Should AI make decisions that affect people's lives, such as job hiring or grading students?*

In Favor (Yes)

- AI can process large amounts of data quickly and accurately.
- It can reduce human errors and save time.
- AI applies the same rules to everyone, making decisions more consistent.
- It can help organizations make faster decisions.

Against (No)

- AI may be biased if it is trained on biased data.
- It cannot understand human emotions, creativity, or personal circumstances.
- AI can make mistakes that unfairly affect people.
- Important decisions should involve human judgment and responsibility.

Conclusion

AI should be used as a tool to assist people, but final decisions about job hiring, student grading, and other important matters should be made by humans. This ensures fairness, accountability, and consideration of individual situations.



DO YOU KNOW?

- An AI that understands different languages and cultures can serve people from all backgrounds more effectively.

Ethical Principles in AI

Q. Explain the ethical principles in AI. Also describe bias, inclusivity, conflicts among stakeholders, and policy and legal frameworks.

Ethical Principles in AI

Ethical principles in AI are rules that help develop and use Artificial Intelligence in a fair, safe, and responsible way. Ethical AI development is based on fairness, accountability, transparency, and safety.

Fairness, accountability, transparency, and safety in AI Systems

Fairness

Fairness means AI systems should treat everyone equally. They should not discriminate against people based on gender, region, language, or background.

Accountability

Accountability means there should be a responsible person or organization for the decisions made by an AI system.

Transparency

Transparency means AI systems should explain how they make decisions. Users should understand why a particular decision was made.

Safety

Safety means AI systems should be tested carefully to avoid harmful or incorrect results. They should protect users from harm.

For example, if an AI system is used for student admission, it should not unfairly accept or reject students. The university should also be able to explain the reason for every decision. In healthcare, AI systems must be tested carefully before they are used for disease diagnosis.

Avoiding Bias and Ensuring Inclusivity in AI Design

AI systems learn from data. If the training data contains bias, the AI system may also produce unfair results.

For example, if a hiring system is trained mostly on records of male employees, it may unfairly prefer male candidates.

Similarly, if a face recognition system is trained mainly on images of one age group, skin tone, or region, it may not work correctly for other people. Developers should carefully check and improve training data to reduce bias. Inclusivity means designing AI systems that work fairly for people of different genders, ethnicities, and backgrounds.

Conflict of Interests Among Stakeholders

Different stakeholders may have different goals. Businesses want to collect more data to improve AI systems and increase profit. Users want privacy and control over their personal information. Governments must balance innovation with the protection of citizens' rights and ethical standards. For example, a company may collect large amounts of user data to improve AI. If this data is collected without the user's permission, it can reduce privacy and trust. Clear data policies and user consent help maintain a balance between functionality and ethics.

Policy and Legal Frameworks

Policy and legal frameworks provide rules for the responsible use of AI. The General Data Protection Regulation (GDPR) of the European Union protects data privacy and user rights. AI Ethics Guidelines developed by different organizations promote accountability, fairness, transparency, and respect for human dignity. For Pakistan, national AI policies are important to encourage innovation while ensuring ethical use of AI. These policies can protect data, support AI research, and promote AI solutions that meet local values and needs. They also help build public trust and support national development.



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- Balancing privacy and innovation is one of the biggest challenges in today's tech-driven world.



CLASS ACTIVITY

Role-play a company meeting where developers want to collect user data and privacy advocates oppose it. Discuss solutions.

Sol: Topic: A company meeting where developers want to collect user data and privacy advocates oppose it.

Characters

- Project Manager
- Developer
- Privacy Advocate
- Customer Representative

Role-Play

Project Manager: We need to decide how much user data our app should collect.

Developer: Collecting more data will help improve app features, fix problems, and provide personalized services.

Privacy Advocate: We should collect only the data that is necessary. Users have the right to privacy and should know how their data is used.

Customer Representative: Users want useful features, but they also want their personal information to be safe.

Project Manager: How can we satisfy both needs?

Developer: We can ask users for permission before collecting data and protect it with encryption.

Privacy Advocate: We should also allow users to view, update, or delete their data and clearly explain our privacy policy.

Customer Representative: These steps will increase user trust and confidence.

Solutions

- Collect only the necessary data.
- Ask for user consent before collecting data.
- Protect data using encryption and other security measures.
- Provide a clear and simple privacy policy.
- Allow users to access, update, or delete their personal data.
- Follow privacy laws and regulations.

Conclusion:

A balance between innovation and privacy is the best solution. Companies should improve their services while respecting and protecting users' personal information.



Additional Multiple Choice Questions

- AI systems involve different stakeholders. Which of the following is a stakeholder in AI systems?
A) Developers B) Printers C) Routers D) Scanners
- Which stakeholder creates laws and policies for the safe and fair use of AI?
A) Users B) Communities C) Governments D) Developers
- Ethical principles in AI are rules that help develop and use Artificial Intelligence in a:
A) Fast and cheap way B) Fair, safe, and responsible way C) Manual way D) Complex way
- Fairness means AI systems should:
A) Treat everyone equally B) Collect more data
C) Increase profit D) Work faster
- Transparency means AI systems should:
A) Keep decisions secret B) Explain how they make decisions
C) Avoid users D) Store more data
- If the training data contains bias, the AI system may also produce:
A) Faster results B) Better graphics C) Fair results D) Unfair results
- Inclusivity means designing AI systems that work fairly for people of different:
A) Computers only B) Programming languages only
C) Genders, ethnicities, and backgrounds D) Internet speeds
- Which policy protects data privacy and user rights in the European Union?
A) HTTP B) GDPR C) IoT D) AWS
- Which of the following is an example of ethical use of AI?
A) A company collects user data without permission.
B) An AI system hides the reason for its decisions.
C) AI system treats all applicants fairly and protects personal data.
D) An AI system prefers one gender over another.
- Why should AI developers consider local traditions and social behavior when designing AI systems?
A) To reduce internet speed
B) To make AI more useful and respectful for different cultures
C) To increase hardware costs
D) To replace human decision-making completely

Answers:

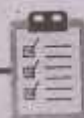
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8.3 Designing Applications for Pakistan Using Emerging Technologies



DO YOU KNOW?

- Technology can help address major challenges in Pakistan, such as water shortages, limited access to education, and healthcare delivery.



CLASS ACTIVITY

Sketch a simple app interface (on paper or digitally) that uses AI, IoT, or Cloud to solve a real-world problem.
Sol:

Smart Waste Management App Using IoT + AI + Cloud

Purpose:

This app uses smart bins (IoT) to monitor waste levels and AI to predict collection needs. Data is stored in the Cloud and helps keep cities clean and efficient.

How it Works:

- IoT sensors in bins send real-time data.
- AI predicts when bins will be full.
- Data is stored in the Cloud.
- System suggests the best collection routes.



Benefits:

- ✓ Cleaner environment
- ✓ Smarter collection routes
- ✓ Saves time and fuel
- ✓ Reduces costs
- ✓ Better use of resources

Technologies Used:

- IoT Sensors
- AI (Prediction)
- Cloud Computing
- Smart City, Clean City!



CLASS ACTIVITY

Form mixed groups (technology, social science, business). Design a collaborative project that uses technology to solve a community issue.

Sol: Community Issue: Garbage collection and littering in the community

Project Name: Smart Clean Community

Group Members and Roles:

- **Technology Team:** Develops a mobile app for reporting garbage locations.
- **Social Science Team:** Conducts surveys to identify the most affected areas and raises public awareness.
- **Business Team:** Prepares the project budget, finds sponsors, and manages resources.

Technology Used:

- Mobile App
- GPS Location
- Cloud Database

How It Works:

1. Citizens report garbage by uploading a photo and location through the app.
2. The report is stored in a cloud database.
3. The local cleaning team receives the report and removes the garbage.
4. The app updates the status after the area is cleaned.

Benefits:

- Keeps the community clean.
- Saves time in reporting problems.
- Encourages community participation.
- Improves public health and the environment.

Ex.Q.6 Identify key national challenges in Pakistan and describe how emerging technologies (AI, IoT, Cloud, Blockchain) can provide effective and innovative solutions.

Pakistan faces many national challenges that affect the country's development. Emerging technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Cloud Computing, and Blockchain provide smart, efficient, and innovative solutions to improve different sectors.

1. Healthcare

Challenge: Pakistan has limited access to medical services, especially in rural areas. There is also a shortage of doctors, hospitals, and medical resources.

Solution: AI can analyze medical data and help doctors diagnose diseases quickly and accurately. Cloud Computing stores patient records securely and allows hospitals to access them from different locations. This improves healthcare services and makes medical information easier to manage.

2. Education

Challenge: Many students do not have access to quality education because of a lack of teachers, schools, and learning resources, especially in remote areas.

Solution: Cloud Computing provides online books, videos, and educational content that students can access anytime and anywhere. AI supports personalized learning by helping students learn according to their abilities and progress.

3. Agriculture

Challenge: Farmers face low crop production due to inefficient farming methods, water shortages, and changing weather conditions.

Solution: IoT uses sensors to monitor soil moisture, temperature, humidity, and weather conditions. The collected data helps farmers use water and fertilizers efficiently, improving crop production and reducing waste.

4. Governance

Challenge: Government departments need greater transparency, security, and efficiency in managing public records and services.

Solution: Blockchain stores government records securely and prevents unauthorized changes. It increases transparency, reduces fraud and corruption, and makes public services more reliable and trustworthy.

These emerging technologies help Pakistan improve healthcare, education, agriculture, and governance by providing smart, efficient, and innovative solutions.

Q. Design an innovative technology-based application to solve a real-world problem in Pakistan using emerging technologies.

Innovative Application Design

Developing technology-based applications begins by identifying a real-world problem. The most suitable emerging technology is then selected to solve that problem.

- AI can be used in intelligent tutoring systems.
- IoT can be used for smart city management.
- Cloud Computing can provide secure access to data.
- Blockchain can be used for record authentication.

Students should develop creative ideas that solve Pakistan's social and economic problems. Applications for water management, traffic control, and education accessibility help improve society and encourage critical thinking.

Technology Integration

Many modern solutions combine more than one emerging technology.

- AI provides intelligent decision-making.
- IoT connects devices and collects data.
- Cloud Computing stores and processes data.
- Blockchain provides security and transparency.

Combining these technologies creates smarter systems that can improve and adapt over time.

For example, a smart irrigation system uses IoT sensors to measure soil moisture, AI to predict water needs, and Cloud Computing to store and analyze data. This helps farmers save water, reduce costs, and increase crop production.

Ex.Q.7 Discuss the ethical and cultural considerations involved in designing AI systems. How can developers ensure inclusivity and respect for local values?

Ethical and Cultural Considerations

When designing AI systems, developers should consider ethical and cultural values to ensure that technology benefits everyone. AI applications should be fair, inclusive, secure, and respectful of Pakistan's traditions and social values.

1. Respect Cultural Values

AI systems should respect Pakistan's cultures, traditions, customs, and social values. They should avoid content or decisions that may conflict with local beliefs.

2. Support Regional Languages

AI applications should support regional and local languages so that people from different areas can use them easily. This makes technology accessible to more users.

3. Ensure Inclusivity

AI systems should be designed for all users, including people of different ages, backgrounds, and abilities. Simple interfaces and easy-to-understand features help everyone use the technology.

4. Protect Privacy and Data

Developers should protect users' personal information and ensure that data is collected, stored, and used securely. AI systems should prevent the misuse of personal data.

5. Promote Fairness

AI systems should make fair and unbiased decisions without discriminating against any individual or group. They should treat all users equally.

6. Create Positive Social Impact

AI should be designed to solve real-world problems and improve people's lives in areas such as education, healthcare, agriculture, and public services while respecting local community needs.

7. Follow Responsible Design Practices

Developers should test AI systems carefully, collect user feedback, and update them regularly to ensure they remain accurate, secure, and suitable for local communities.

By following these practices, developers can ensure that AI systems are inclusive, respect local values, protect users' privacy, and provide fair and beneficial solutions for society.



TIDBIT

➤ Technology succeeds when it respects local traditions, beliefs, and user needs.

Q. Explain the case study of Smart Agriculture in Pakistan.

Case Study: Smart Agriculture in Pakistan

Smart Agriculture in Pakistan uses emerging technologies to improve farming, increase crop production, and use resources more efficiently.

Using IoT Sensors for Soil Monitoring

IoT sensors collect real-time data about soil moisture, temperature, and nutrients. This information helps farmers decide when and how much to water their crops. As a result, farming becomes more efficient, and water and other resources are used wisely.

AI for Predictive Weather Analysis

AI analyzes weather data to predict rainfall, drought, and temperature changes. These predictions help farmers plan their farming activities in advance. They can also protect crops from weather-related damage, which improves crop production and reduces losses.

Cloud for Data Storage

Cloud Computing stores agricultural data securely and allows quick access to it through the internet. Farmers, researchers, and policymakers can easily access the stored data whenever needed.

Blockchain for Supply Chain Transparency

Blockchain records every stage of crop production and distribution. It makes the supply chain more transparent and reduces fraud. It also helps ensure fair trade between farmers, buyers, and sellers.

Together, Cloud Computing and Blockchain create a reliable and trustworthy agricultural system.

Example

A farmer uses IoT sensors to check soil moisture. AI predicts rain for the next day, so the farmer delays irrigation. The farming data is stored in the cloud, and Blockchain records the crop's journey from the farm to the market. This helps save water, improve crop production, and ensure transparent trade.

8.4 Policies, Regulations, and Responsible Innovation

Q. Describe the role of AI governance and responsible technology in ensuring the safe, fair, and ethical use of emerging technologies.

AI governance and responsible technology help ensure that emerging technologies are used safely, fairly, and ethically for the benefit of society.

Understanding AI Governance

Emerging technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and Blockchain affect many areas of human life. They influence privacy, employment, decision-making, and security.

Without proper laws and regulations, these technologies can be misused or produce unfair results. Policies define how data should be collected, stored, and used. They help protect people's rights and ensure the safe use of technology. International frameworks such as the General Data Protection Regulation (GDPR) set rules for data protection and privacy.

AI ethics guidelines also promote fairness and transparency in automated decision-making. Many countries are developing AI policies to support responsible innovation. Pakistan can also develop similar policies to encourage technological growth while protecting the rights of its citizens.

Developing Responsible Technology

Responsible technology means developing technology for the benefit of people instead of focusing only on financial profit. Technology should improve the quality of life, create new opportunities, and reduce harm. Developers should also consider the long-term social and environmental effects of their systems. This helps ensure that technology benefits all communities fairly.

Collaboration Across Disciplines

Developing responsible technology requires experts from different fields to work together.

Legal Experts

Legal experts ensure that technology follows laws and regulations.

Sociologists

Sociologists study how technology affects people and society.



Figure 8.7: Policies and Ethical Guidelines Ensure Responsible Innovation and Protect User Rights in Technology Development.

Ethicists

Ethicists help ensure that technology follows moral and ethical values. Working together, these experts develop balanced solutions that support innovation while protecting people. Technology should also consider differences in language, culture, and accessibility. This helps developers create systems that work fairly for everyone. Collaboration across different fields supports inclusive, fair, and sustainable technological development.

Ex.Q.8. Describe the importance of policies, regulations, and interdisciplinary collaboration in promoting responsible innovation. How can Pakistan benefit from adopting global AI governance standards?

Responsible innovation ensures that emerging technologies are developed and used safely, fairly, and ethically. Policies, regulations, and collaboration among experts help protect people and encourage the responsible use of technology.

1. Importance of Policies and Regulations

Policies and regulations define how technology should be developed and used. They ensure that data is collected, stored, and used responsibly. They also protect people's privacy, reduce the misuse of technology, and promote fairness and transparency in AI systems.

2. Importance of Interdisciplinary Collaboration

Developing responsible technology requires experts from different fields to work together.

- **Legal experts** ensure that technology follows laws and regulations.
- **Sociologists** study how technology affects people and society.
- **Ethicists** ensure that technology follows moral and ethical values.

This collaboration helps create balanced, inclusive, and responsible technology that benefits everyone.

3. Benefits of Global AI Governance Standards for Pakistan

International frameworks, such as the **General Data Protection Regulation (GDPR)** and **AI ethics guidelines**, provide standards for data protection, privacy, fairness, and transparency. By adopting similar AI governance standards, Pakistan can:

- Protect citizens' privacy and personal data.
- Promote fair and transparent AI systems.
- Prevent the misuse of emerging technologies.
- Encourage responsible innovation and technological growth.
- Build public trust in AI-based systems.
- Support sustainable social and economic development.

By following effective policies, encouraging collaboration among experts, and adopting global AI governance standards, Pakistan can develop responsible technologies that protect citizens' rights while promoting innovation.

? DO YOU KNOW?

- Combining AI, IoT, Cloud, and Blockchain can create smarter and more efficient systems for everyday life.

TIDBIT

- The best technologies put people first, ethics and empathy are key ingredients in innovation.



Additional Multiple Choice Questions

1. Emerging technologies help solve Pakistan's national challenges by providing:
A) Smart, efficient, and innovative solutions B) Manual record keeping
C) Traditional methods only D) Offline communication
2. Which emerging technology can analyze medical data for faster disease diagnosis?
A) Blockchain B) Cloud Computing
C) Artificial Intelligence (AI) D) Internet of Things (IoT)
3. Which emerging technology can improve transparency in governance?
A) Cloud Computing B) Blockchain
C) Artificial Intelligence (AI) D) Internet of Things (IoT)
4. Which emerging technology can be used for smart city management?
A) Blockchain B) Cloud Computing
C) Artificial Intelligence (AI) D) Internet of Things (IoT)
5. In a smart irrigation system, IoT sensors are used to:
A) Measure soil moisture B) Store farming data
C) Record crop transactions D) Predict market prices
6. Blockchain records every stage of crop production and distribution to improve:
A) Entertainment B) Supply chain transparency
C) Internet speed D) Weather forecasting
7. Responsible technology means developing technology for the benefit of people instead of focusing only on:
A) Education B) Automation C) Financial profit D) Agriculture
8. Which stakeholder ensures that technology follows laws and regulations?
A) Ethicists B) Sociologists C) Software developers D) Legal experts
9. International frameworks such as the General Data Protection Regulation (GDPR) set rules for:
A) Data protection and privacy B) Software installation
C) Network communication D) Computer repair
10. Why is collaboration across different fields important in developing responsible technology?
A) It increases hardware sales.
B) It reduces internet usage.
C) It supports inclusive, fair, and sustainable technological development.
D) It replaces the need for experts.

Answers:

1	A	2	C	3	B	4	D	5	A	6	B	7	C	8	D	9	A	10	C
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TEXTBOOK EXERCISE (SOLVED)

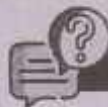


MULTIPLE CHOICE QUESTIONS

- Artificial Intelligence (AI) is best described as:**
 (a) A system that connects devices to the Internet
 (b) A program that performs human-like tasks
 (c) A method of storing files online
 (d) A social media algorithm
- The Internet of Things (IoT) is mainly used to:**
 (a) Allow devices to communicate automatically
 (b) Store documents securely
 (c) Manage Internet connections
 (d) Create digital art
- An example of cloud computing is:**
 (a) Google Drive (b) Microsoft Word (c) Smartwatch (d) USB flash drive
- Blockchain technology is known for:**
 (a) Decentralized and secure records
 (b) Temporary file storage
 (c) High-speed networking
 (d) Real-time video editing
- An ethical issue in AI systems is:**
 (a) Data bias in decision-making (b) Using colorful interfaces (c) Quick data analysis (d) Saving battery power
- The purpose of AI governance policies is to:**
 (a) Increase automation speed
 (b) Protect privacy and ensure responsible use
 (c) Reduce programming errors
 (d) Promote entertainment content
- In agriculture, IoT and AI can work together to:**
 (a) Automate soil and crop monitoring
 (b) Create social media advertisements
 (c) Manage financial transactions
 (d) Generate artwork
- Transparency in agriculture supply chains can be improved using:**
 (a) Blockchain and cloud computing (b) HTML and CSS (c) GPS and Wi-Fi (d) Python and Excel
- Responsible technology development should:**
 (a) Focus only on business profit
 (b) Ensure fairness and accountability
 (c) Avoid community input
 (d) Limit global access
- Cultural awareness in AI design ensures:**
 (a) Faster algorithm performance
 (b) Respect for local values and norms
 (c) Reduced data collection
 (d) Larger system databases

Answers:

1	B	2	A	3	A	4	A	5	A	6	B	7	A	8	A	9	B	10	B
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SHORT QUESTIONS

- What is Artificial Intelligence (AI) and how is it used in daily life?**
Ans: Artificial Intelligence (AI) is a branch of computer science that enables machines to perform tasks that typically require human intelligence. AI is used in daily life in voice assistants, face recognition, online shopping recommendations, navigation apps, and smart devices to make work easier and faster.
- How does the Internet of Things (IoT) connect smart devices together?**
Ans: The Internet of Things (IoT) refers to a network of physical devices connected through the internet that can collect, share, and act on data. IoT connects smart devices together through sensors, software, and internet connectivity. This allows devices to communicate, share data automatically and work together without human intervention.
- What are the main advantages of using Cloud Computing?**
Ans: It stores and accesses data over the internet. It allows access to files from anywhere. It makes data sharing easy. It reduces storage costs. It supports teamwork.

4. **How does Blockchain ensure security and transparency in transactions?**

Ans: Blockchain ensures security by storing data in encrypted and linked blocks that are difficult to change. It ensures transparency because every transaction is recorded and can be verified by all authorized users. This makes transactions secure, reliable, and difficult to tamper with.

5. **Why is it important to consider ethics while developing AI systems?**

Ans: It is important to consider ethics while developing AI systems because AI affects people's privacy, decision-making, and security. Ethical principles ensure fairness, transparency, and responsible use of AI. They also help protect people's rights and prevent misuse of technology.

6. **What role do stakeholders play in the design and regulation of AI technologies?**

Ans: Stakeholders play an important role in the design and regulation of AI technologies by helping develop AI systems that are safe, fair, and responsible. Legal experts make sure AI follows the law. Sociologists study how AI affects people and society. Ethicists make sure AI is fair and used in the right way. Together, they help protect people and support the safe use of AI.

7. **How can emerging technologies help solve national challenges in Pakistan?**

Ans: Emerging technologies can help solve national challenges in Pakistan by improving agriculture, healthcare, education, and other public services. For example, AI helps in making better decisions, IoT collects real-time data, Cloud Computing stores and shares data, and Blockchain provides secure and transparent records.

8. **What is the importance of cultural awareness when designing technological solutions?**

Ans: Cultural awareness helps developers design technology that respects local cultures, traditions, and values. AI systems should support regional languages, respect local customs, and protect users' privacy. This makes technology fair, inclusive, and useful for everyone.

9. **How can AI, IoT, and Cloud work together to improve agriculture?**

Ans: IoT sensors collect data about soil moisture, temperature, and crops. AI analyzes this data and recommends the right farming decisions. Cloud Computing stores and processes the data, allowing farmers to access it anytime. Together, these technologies improve crop production, save water, and reduce costs.

10. **Why are laws and policies necessary for the responsible and safe use of technology?**

Ans: Laws and policies help ensure that technology is used safely, fairly, and ethically. They protect people's rights and define how data should be collected, stored, and used. They also prevent misuse of technology and promote responsible innovation.



LONG QUESTIONS

All Qs are Solved in chapter

1. Explain how Artificial Intelligence (AI), the Internet of Things (IoT), Cloud Computing, and Blockchain are transforming modern industries. Give suitable examples for each technology.
2. Discuss the benefits and challenges of Artificial Intelligence (AI) in society. How can ethical principles ensure fair and responsible use of AI?
3. Describe how IoT devices collect and communicate data for automation. How is IoT improving sectors such as healthcare, agriculture, and smart homes?
4. Explain how Cloud Computing supports scalability, accessibility, and collaboration. Compare different cloud platforms like Google Drive, AWS, and Microsoft Azure.
5. What is Blockchain technology? Discuss how its decentralized nature improves transparency and security in financial and non-financial applications.
6. Identify key national challenges in Pakistan and describe how emerging technologies (AI, IoT, Cloud, Blockchain) can provide effective and innovative solutions.
7. Discuss the ethical and cultural considerations involved in designing AI systems. How can developers ensure inclusivity and respect for local values?
8. Describe the importance of policies, regulations, and interdisciplinary collaboration in promoting responsible innovation. How can Pakistan benefit from adopting global AI governance standards?

ADDITIONAL SHORT QUESTIONS

Emerging Technologies

1. What are emerging technologies?

Ans: Emerging technologies are new and advanced technologies that improve different areas of life. They help people work faster, communicate better, and manage information more easily. Artificial Intelligence (AI), the Internet of Things (IoT), Cloud Computing, and Blockchain are examples of emerging technologies. These technologies make work faster, easier, and more efficient.

2. Explain how emerging technologies are changing different industries.

Ans: Emerging technologies create smarter systems for data management, automation, and connectivity. They are widely used in healthcare, education, transportation, and agriculture. They help people work faster and improve the quality of services. They also support innovation and solve many local and global challenges.

Artificial Intelligence (AI)

3. How do AI systems learn and improve their performance?

Ans: AI systems learn through a process called machine learning. In this process, algorithms are trained using large amounts of data. As the system processes more data, its performance becomes more accurate. This helps AI make better decisions over time.

4. Describe the common applications of Artificial Intelligence (AI).

Ans: AI is used in voice assistants, chatbots, image recognition, recommendation systems, and self-driving cars. Voice assistants understand spoken commands and provide useful responses. Chatbots answer customers' questions automatically, while recommendation systems suggest videos and products.

Internet of Things (IoT)

5. What is the Internet of Things (IoT)?

Ans: The Internet of Things (IoT) is a network of physical devices connected through the internet. These devices can collect, share, and act on data. They include sensors, processors, and communication hardware. IoT creates a smart environment where devices work with very little human effort.

6. How does the Internet of Things (IoT) improve automation and daily life?

Ans: IoT devices collect data from the environment and send it to cloud-based systems for processing. After analyzing the data, the system performs actions automatically. Automation reduces manual work, saves time, and minimizes human error. It also creates smarter, safer, and more efficient homes, industries, and communities.

7. Describe how IoT devices collect and communicate data for automation. (Exercise Style)

Ans: IoT sensors collect data from the environment such as temperature, movement, and humidity. The collected data is sent to cloud-based systems or servers for processing and analysis. After analyzing the data, the system performs actions automatically. Automation saves time, reduces manual work, and minimizes human error.

8. How is IoT improving healthcare and agriculture?

Ans: In healthcare, IoT sensors monitor patients' heart rate, blood pressure, and glucose levels in real time. Doctors can monitor patients remotely and respond quickly during emergencies. In agriculture, IoT devices measure soil moisture, temperature, and weather conditions. This helps farmers improve irrigation, increase production, and reduce waste.

9. How are emerging technologies changing different industries?

Ans: Emerging technologies are creating smarter systems for data management, automation, and connectivity. They are widely used in healthcare, education, transportation, and agriculture. These technologies help people work faster and improve the quality of services. They also support innovation and solve many real-world problems.

Cloud Computing

10. What is Cloud Computing?

Ans: Cloud Computing is a technology that allows users to store, manage, and process data on remote servers instead of local computers. These servers are hosted on the internet and managed by cloud service providers. Users can access their data and applications anytime, from anywhere, using an internet connection. It makes computing more flexible and connected.

11. How does Cloud Computing support scalability, accessibility, and cost effectiveness?

Ans: Cloud Computing allows users to increase or decrease storage space and computing power according to their needs. It also allows users to access data and applications from different devices and locations. Users usually pay only for the services they use through a pay-as-you-go model. This reduces operating costs and supports growing businesses.

12. Describe the uses of Amazon Web Services (AWS), Microsoft Azure, and Google Drive.

Ans:

- Amazon Web Services (AWS) provides cloud services such as web hosting, data storage, and application development.
- Microsoft Azure allows developers to create, manage, and run applications through the cloud.
- Google Drive allows users to store, access, and share files over the internet. These platforms are important parts of modern digital infrastructure.

13. Why do individuals and businesses use Cloud Computing?

Ans: Cloud Computing allows individuals and businesses to use online services without maintaining physical hardware. It supports data storage, web hosting, and software applications. Users can access their files anytime from different devices. It also reduces the need for expensive servers and maintenance.

Blockchain Technology

14. What is Blockchain technology?

Ans: Blockchain technology is a digital system that securely stores and shares information across many computers instead of a single central server. Each verified record, or block, links to the previous one to form an unchangeable chain. Every computer in the network keeps a copy of the blockchain. This makes the system secure and reliable.

15. Describe the applications of Blockchain technology.

Ans: Blockchain is used in finance to support cryptocurrencies such as Bitcoin. It is used in supply chain management to track goods and verify the authenticity of products. It also provides secure storage for legal documents, medical records, and certificates. Governments, businesses, and educational institutions also use blockchain for secure record management.

16. How is Blockchain used in finance and supply chain management?

Ans: In finance, Blockchain supports cryptocurrencies such as Bitcoin and allows secure peer-to-peer transactions. In supply chain management, it tracks goods from their origin to the customer. It helps verify the authenticity of products and improves transparency. This increases trust and reliability.

17. Differentiate between Cloud Computing and Blockchain Technology.

Ans:

Cloud Computing	Blockchain Technology
Cloud Computing stores, manages, and processes data on remote servers through the internet.	Blockchain securely stores and shares information across many computers instead of a single central server.
It provides services such as data storage, web hosting, and software applications.	It provides secure, transparent, and tamper-proof record management for different applications.

Cultural and Ethical Implications of AI Systems

18. Explain the cultural and ethical implications of AI systems.

Ans: Artificial Intelligence (AI) affects the way people live, work, and use technology. AI systems are not only technical tools but also social tools that influence individuals, communities, and governments. Therefore, it is important to consider their cultural and ethical effects. This helps ensure the responsible use of AI.

Ethical Principles in AI

19. What are ethical principles in AI?

Ans: Ethical principles in AI are rules that help develop and use Artificial Intelligence in a fair, safe, and responsible way. Ethical AI development is based on fairness, accountability, transparency, and safety. These principles help protect users and build trust. They also encourage the responsible use of AI.

20. Explain the principles of fairness, accountability, transparency, and safety in AI.

Ans: Fairness means AI should treat everyone equally without discrimination. Accountability means a responsible person or organization should answer for AI decisions. Transparency means AI should explain how it makes decisions. Safety means AI systems should be tested carefully to avoid harmful or incorrect results.

21. How can developers avoid bias and ensure inclusivity in AI design?

Ans: Developers should carefully check and improve training data to reduce bias. This helps prevent unfair results in AI systems. Inclusivity means designing AI systems that work fairly for people of different genders, ethnicities, and backgrounds. This makes AI fair and reliable for everyone.

22. Explain the conflict of interests among stakeholders in AI systems.

Ans: Different stakeholders have different goals. Businesses want to collect more data to improve AI systems and increase profit. Users want privacy and control over their personal information. Governments must balance innovation with the protection of citizens' rights and ethical standards.

23. Why are policy and legal frameworks important for AI?

Ans: Policy and legal frameworks provide rules for the responsible use of AI. They protect data privacy and user rights. They also promote fairness, transparency, and accountability in AI systems. In Pakistan, national AI policies can support innovation while ensuring ethical use of AI.

24. Explain how emerging technologies improve healthcare, education, agriculture, and governance.

Ans: AI analyzes medical data for faster disease diagnosis in healthcare. Cloud Computing stores and provides educational content in education. IoT monitors environmental conditions in agriculture. Blockchain improves transparency and efficiency in governance.

Innovative Application Design

25. How are technology-based applications developed to solve real-world problems?

Ans: Technology-based applications begin by identifying a real-world problem. The most suitable emerging technology is then selected to solve that problem. AI can be used in intelligent tutoring systems, IoT in smart city management, Cloud Computing for secure data access, and Blockchain for record authentication. These applications help solve social and economic problems.

26. Explain how different emerging technologies work together in modern solutions.

Ans: Many modern solutions combine more than one emerging technology. AI provides intelligent decision-making, while IoT connects devices and collects data. Cloud Computing stores and processes data, and Blockchain provides security and transparency. Together, they create smarter systems that improve and adapt over time.

27. Why are ethical and cultural considerations important when designing technology-based solutions?

Ans: Technology-based solutions should respect Pakistan's cultures, traditions, and values. Applications should be inclusive and easy for everyone to use. AI systems should support regional languages and respect local customs. Developers should also protect users' privacy and avoid the misuse of data.

28. What are Neural Networks (NN)?

Ans: Neural Networks (NN) are AI models that work like the human brain. They learn from large amounts of data to recognize patterns, make predictions, and solve problems such as image recognition and speech recognition.

Example: A face recognition system uses a neural network to identify people in photos.

29. What are Natural Language Processing (NLP)?

Ans: Natural Language Processing (NLP) is a branch of AI that enables computers to understand, interpret, and generate human language.

Example: ChatGPT, Google Translate, Siri, and chatbots use NLP to understand and respond to human language.

CONCEPTUAL SHORT QUESTIONS

1. **A hospital wants to detect diseases quickly from medical scans. Which technology should it use and how?**
Ans: The hospital can use **Artificial Intelligence (AI)** with image recognition to identify medical conditions from scans. AI can help doctors detect diseases quickly and accurately.
2. **A farmer wants to know when his crops need water. How can IoT help him?**
Ans: IoT sensors can measure the moisture level of the soil and send the data to a system for analysis. The irrigation system can then start automatically when the soil becomes dry.
3. **A student wants to access an assignment from both a mobile phone and a computer. Which technology can help?**
Ans: The student can use **Cloud Computing**, such as Google Drive, to store the assignment online. The file can then be accessed from different devices using an internet connection.
4. **A company wants to keep its transaction records secure and difficult to change. Which technology should it use?**
Ans: The company can use **Blockchain technology** to store its records across many computers. Its decentralized and linked structure makes records secure, transparent, and difficult to tamper with.
5. **A smart home owner wants lights to turn off automatically when nobody is in a room. How can this be achieved?**
Ans: IoT sensors can detect whether someone is present in the room. After analyzing the sensor data, the system can automatically turn the lights off, reducing energy use and manual work.
6. **An online store receives thousands of customer questions every day. Which AI application can help?**
Ans: The store can use **AI chatbots** to answer customers' questions automatically. This allows the business to respond to many customers at the same time and improve efficiency.
7. **A school wants an AI system for student grading. What ethical principles should be considered?**
Ans: The AI system should follow **fairness, transparency, accountability, and safety**. It should avoid biased decisions and the school should be able to understand and explain how important decisions are made.
8. **A Pakistani farmer wants to reduce water waste and protect crops from changing weather. How can emerging technologies help?**
Ans: IoT sensors can monitor soil moisture, while AI can analyze weather data and predict rainfall. Cloud Computing can store the agricultural data so it can be accessed and analyzed when needed.
9. **A government department wants to make its public records more transparent and secure. Which technology can it use?**
Ans: The department can use **Blockchain** to securely store government records and prevent unauthorized changes. It can increase transparency, reduce fraud, and make public services more trustworthy.
10. **An AI application is being developed for people from different regions of Pakistan. What should developers do to make it inclusive?**
Ans: Developers should support regional languages and respect local cultures, traditions, and social values. They should also protect users' personal data and design the system so that people of different backgrounds can use it fairly.

TEST YOUR SKILLS

Total Marks: 40

Time: 1:30 Hour

Q.1 MULTIPLE CHOICE QUESTIONS:

8 x 1 = 8

1. A network of physical devices connected through the Internet called:
(a) Telephone network (b) Physical Network (c) Network of Things (d) Internet of Things
2. The Internet of Things (IoT) is mainly used to:
(a) Allow devices to communicate automatically (b) Store documents securely
(c) Manage Internet connections (d) Create digital art
3. An example of cloud computing is:
(a) Google Drive (b) Microsoft Word (c) Smartwatch (d) USB flash drive
4. Which feature of blockchain improves transparency, security, and trust?
(a) Centralized structure (b) Decentralized structure (c) Manual processing (d) Offline storage
5. An ethical issue in AI systems is:
(a) Data bias in decision-making (b) Using colorful interfaces
(c) Quick data analysis (d) Saving battery power
6. Which emerging technology can analyze medical data for faster disease diagnosis?
(a) Blockchain (b) Cloud Computing (c) Artificial Intelligence (AI) (d) Internet of Things (IoT)
7. Transparency in agriculture supply chains can be improved using:
(a) Blockchain and cloud computing (b) HTML and CSS
(c) GPS and Wi-Fi (d) Python and Excel
8. Which policy protects data privacy and user rights in the European Union?
(a) HTTP (b) GDPR (c) IoT (d) AWS

Q.2 SHORT QUESTIONS:

Note: Attempt any 8 short questions

8 x 2 = 16

- i. Describe the common applications of Artificial Intelligence (AI).
- ii. How does IoT make homes smarter and more convenient?
- iii. What is scalability in Cloud Computing?
- iv. What are the main advantages of using Cloud Computing?
- v. Describe the applications of Blockchain technology.
- vi. How does Blockchain ensure security and transparency in transactions?
- vii. How can AI, IoT, and Cloud work together to improve agriculture?
- viii. Explain the principles of fairness, accountability, transparency, and safety in AI.
- ix. How can developers avoid bias and ensure inclusivity in AI design?
- x. Why are laws and policies necessary for the responsible and safe use of technology?

LONG QUESTIONS:

Note: Attempt any 2 long questions

2 x 8 = 16

3. Explain how Artificial Intelligence (AI), the Internet of Things (IoT), Cloud Computing, and Blockchain are transforming modern industries. Give suitable examples for each technology.
4. Explain how Cloud Computing supports scalability, accessibility, and collaboration. Compare different cloud platforms like Google Drive, AWS, and Microsoft Azure.
5. Discuss the ethical and cultural considerations involved in designing AI systems. How can developers ensure inclusivity and respect for local values?