10 CHAPTER

EMERGING TECHNOLOGIES IN COMPUTER SCIENCE

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10.1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

LONG QUESTION

Q.1 How is Artificial Intelligence transforming various industries?

Ans: Artificial Intelligence (AI) is revolutionizing multiple industries by automating processes, optimizing decision-making, and providing more efficient solutions to complex problems. Here are a few examples:

Healthcare:

AI has significantly improved healthcare by enabling faster diagnoses, personalizing treatment plans, and predicting patient outcomes. For instance, AI systems analyze medical records to help doctors identify patterns that might indicate a disease, allowing for early detection and treatment. AI-driven tools also help predict patient outcomes by analyzing past data, which can help doctors make more informed decisions.

Finance:

In the finance industry, AI plays a critical role in fraud detection and algorithmic trading. Machine learning algorithms can detect unusual transaction patterns, alerting banks to potential fraud. Additionally, AI helps in algorithmic trading by analyzing market trends and making rapid decisions, which can lead to more efficient trading strategies.

Transportation:

AI is a key enabler of autonomous vehicles, including self-driving cars, drones, and traffic management systems. AI-powered systems help vehicles navigate roads, detect obstacles, and optimize routes for safety and efficiency. For example, AI in autonomous vehicles makes real-time decisions, such as braking and accelerating, based on sensor data.

Retail and E-Commerce:

AI in e-commerce platforms enhances the shopping experience by providing personalized recommendations, automating customer service with chatbots, and improving inventory management. For example, AI analyzes past purchases and browsing history to suggest products to customers, enhancing user satisfaction and increasing sales.

Agriculture:

In agriculture, AI optimizes crop yields by using predictive analytics to determine the best planting times and detect diseases early through computer vision. For example, AI-driven drones can monitor crop health, and algorithms can predict yield based on environmental data.

Q.2 What are the subfields of Artificial Intelligence (AI), and how does each one contribute to the development of intelligent systems?

Ans: Artificial Intelligence (AI) is a broad field that covers several subfields, each focusing on a different aspect of intelligence and technology. The key subfields of AI include:

Machine Learning (ML):

Machine learning is a type of AI where computers learn from experience. The system improves over time by being exposed to data, without needing explicit programming for every task. It is like teaching a computer by showing it many examples and allowing it to figure out how to perform tasks independently.

Example: If a computer is shown thousands of pictures of cats and dogs, it can learn to distinguish between the two based on the features it has observed, such as shape and color. This ability improves as it is shown more data.

Deep Learning:

Deep learning is a specialized type of machine learning that uses neural networks. These networks are complex structures inspired by the human brain, and they enable machines to make decisions and recognize patterns in data more effectively.

Example: Deep learning powers many advanced systems like facial recognition. For instance, when you use your phone to unlock it with your face, deep learning models help the system recognize your facial features from a large amount of image data.

Natural Language Processing (NLP):

NLP is a technology that enables computers to understand and interact with human language. It allows machines to read, interpret, and generate text or speech in a way that is meaningful to humans.

Example: When you ask a voice assistant like Siri or Alexa a question, they use NLP to understand the words and context of your query. Another example is when your phone suggests words or auto-corrects your text, which is powered by NLP algorithms.

Computer Vision:

Computer vision is a field within AI that enables computers to interpret and understand visual information from the world. This includes recognizing objects, faces, or scenes in images and videos.

Example: Self-driving cars use computer vision to "see" and interpret the road, identifying obstacles, pedestrians, and other vehicles in real-time.

Robotics:

Robotics is the science of designing and programming robots—machines that can perform tasks automatically. Some robots are capable of making decisions and adapting to different situations, mimicking human actions.

Example: In factories, robots are used to build cars and perform repetitive tasks. Robots can also be used in homes for cleaning (e.g., robotic vacuum cleaners) or in medical fields for performing surgeries with precision.

SHORT QUESTION

Q.13 What is Artificial Intelligence (AI)?

Ans:

DEFINITION OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) refers to the simulation of human intelligence in computers. This technology allows machines to think, learn, and perform tasks that typically require human cognitive abilities. For example, AI is used to optimize farming practices by analyzing data from sensors and drones to predict crop yields.

Q.14 Who coined the term "Artificial Intelligence"?

Ans:

THE ORIGIN OF AI

The term "Artificial Intelligence" was coined by John McCarthy in 1956 during the Dartmouth Conference. This event is considered the starting point of AI as an academic field. The conference gathered researchers to discuss how machines could be made to simulate human intelligence, marking a pivotal moment in AI's development.

Q.15 What is the historical context of AI development?

Ans:

EVOLUTION OF AI

The development of AI spans several decades, with major milestones along the way. From the 1950s-1960s, AI research focused on symbolic problem-solving methods. In the 1970s-1980s, expert systems mimicking human decision-making emerged. The 1990s saw the rise of machine learning, followed by deep learning and robotics in the 2000s. Notably, 2011 marked the introduction of voice assistants, and in recent years, models like ChatGPT have further advanced AI's capabilities.

Q.16 What is the Logic Theorist?

Ans:

DEFINITION AND SIGNIFICANCE

The Logic Theorist was the first AI program, created in 1955 by Allen Newell and Herbert A. Simon. It was designed to mimic human problem-solving abilities and was a significant milestone in the development of AI.

Q.17 How does AI help in healthcare?

Ans:

AI APPLICATIONS IN HEALTHCARE

In healthcare, AI is used for diagnosing diseases, personalizing treatment plans, and predicting patient outcomes. AI can analyze vast amounts of medical data and provide insights that assist doctors in making more accurate decisions. For instance, AI can predict disease outbreaks by monitoring patient data.

Q.18 What is Natural Language Processing (NLP)?

Ans:

UNDERSTANDING NLP

NLP is a subfield of AI that enables computers to understand and interact with human language. It is used in applications like voice assistants (e.g., Siri, Alexa), where the system interprets spoken commands and responds appropriately. It also powers predictive text and translations.

Q.19 How does AI enhance gaming?

Ans:

AI IN GAMING

AI is used in gaming to create realistic characters, improve player experience, and optimize game design. For example, AI algorithms help design smarter non-player characters (NPCs) that can adapt and respond to player actions, making games more engaging.

Q.20 How is AI used in transportation?

Ans:

AI IN TRANSPORTATION

AI is essential in transportation for optimizing routes, enhancing safety, and managing traffic. For example, self-driving cars use AI to navigate roads, detect obstacles, and make decisions in real time, reducing the need for human intervention.

Q.21 What role does AI play in the automobile industry?

Ans:

AI IN THE AUTOMOBILE INDUSTRY

AI is transforming the automobile industry by enabling autonomous driving and advanced driver assistance systems. AI also helps optimize vehicle performance and maintenance. For example, AI-powered systems can predict when a vehicle needs servicing based on data analysis.

Q.10 How does AI assist in social media?

Ans:

AI IN SOCIAL MEDIA

In social media, AI is used for personalized content recommendations, sentiment analysis, and targeted advertising. AI can analyze user behavior and preferences to tailor content, such as suggesting videos or posts, enhancing engagement.

Q.22 What is Machine Learning?

Ans:

DEFINITION OF MACHINE LEARNING

Machine Learning is a type of AI where computers improve their performance by learning from data without being explicitly programmed. For example, email systems use machine learning to filter spam based on patterns identified in previous emails.

Q.23 What is Deep Learning?

Ans:

UNDERSTANDING DEEP LEARNING

Deep Learning is a subset of Machine Learning that uses complex neural networks to analyze large amounts of data. This approach is inspired by the human brain and is used in applications like facial recognition and voice assistants.

Q.24 How does AI benefit the finance industry?

Ans:

AI APPLICATIONS IN FINANCE

AI helps in finance by enabling personalized investment recommendations, fraud detection, and algorithmic trading. It improves decision-making, enhances efficiency, and provides customized financial services. For example, AI can predict stock market trends using historical data.

Q.25 What is the significance of the Dartmouth Conference in AI history?

Ans:

THE DARTMOUTH CONFERENCE

The Dartmouth Conference, held in 1956, is considered the birthplace of AI as a research field. During this event, the term "Artificial Intelligence" was coined, and researchers gathered to

discuss the potential of creating machines capable of simulating human intelligence.

Q.26 How is AI used in e-commerce?

Ans:

AI IN E-COMMERCE

In e-commerce, AI is used for personalized product recommendations, intelligent chatbots for customer support, and fraud detection. AI helps optimize the shopping experience by predicting what customers might like based on their browsing and purchasing history.

Q.27 What are the subfields of AI?

Ans:

SUBFIELDS OF AI

The subfields of AI include Machine Learning, Deep Learning, Natural Language Processing (NLP), Computer Vision, and Robotics. Each subfield focuses on different aspects of intelligence, such as learning from data (Machine Learning), understanding language (NLP), and recognizing images (Computer Vision).

Q.28 How does Computer Vision work in AI?

Ans:

UNDERSTANDING COMPUTER VISION

Computer Vision enables computers to interpret and analyze visual data from images and videos. AI systems use computer vision to perform tasks like recognizing faces, detecting objects, and reading text in images. For example, AI-powered cameras can detect diseases in crops by analyzing plant images.

Q.29 What is the role of Robotics in AI?

Ans:

AI IN ROBOTICS

Robotics is a branch of AI that focuses on designing and programming robots to perform tasks autonomously. Robots can be programmed to perform simple tasks like vacuuming floors or complex tasks like assembling cars in factories. Some robots also use AI to make decisions and learn from experience.

MULTIPLE CHOICE QUESTIONS

88. What is Artificial Intelligence (AI)?

(A) A system that simulates human thinking. (B) A robot-building process.
(C) A programming language. (D) A tool for internet browsing.

89. Who coined the term "Artificial Intelligence"?

(A) Alan Turing (B) John McCarthy
(C) Herbert Simon (D) Allen Newell

90. Which year is associated with the Dartmouth Conference?

(A) 1955 (B) 1956
(C) 1960 (D) 1980

91. What was the first AI program called?

(A) Logic Programmer (B) AI Assistant
(C) Logic Theorist (D) Deep Thinker

92. What is the role of AI in agriculture?

(A) Traditional farming methods (B) Disease detection and predictive analytics
(C) Increasing manual labor (D) None of the above

93. Which subfield of AI uses neural networks?

(A) Machine Learning (B) Robotics
(C) Deep Learning (D) Natural Language Processing

94. What does Natural Language Processing (NLP) enable computers to do?

(A) Understand and process visual information (B) Build robots
(C) Understand human language (D) Learn from examples

95. Which application uses AI for autonomous driving?

(A) Finance (B) Education
(C) Automobile (D) Social Media

96. In which year was ChatGPT introduced?
(A) 2000 (B) 2011
(C) 2023 (D) 2021

97. What is Machine Learning?
(A) A programming tool for robots (B) Computers learning from data
(C) Designing physical robots (D) Analyzing images

98. What does AI improve in the finance industry?
(A) Fraud detection and algorithmic trading (B) Crop health monitoring
(C) Social media engagement (D) Predictive gaming patterns

99. Which AI subfield focuses on understanding visual data?
(A) NLP (B) Robotics
(C) Computer Vision (D) Machine Learning

100. What was a major AI milestone in the 1990s?
(A) Expert systems (B) Symbolic methods
(C) Machine Learning advancements (D) Deep Learning

101. What do expert systems mimic?
(A) Human decision-making (B) Physical tasks
(C) Voice recognition (D) Image processing

102. Which AI application personalizes student learning?
(A) Transportation (B) Healthcare
(C) Education (D) Social Media

103. Which technology powers self-driving cars?
(A) Natural Language Processing (B) AI
(C) Traditional algorithms (D) Blockchain

104. What is the primary role of robotics in AI?
(A) Processing languages (B) Building and programming robots
(C) Predicting stock market trends (D) Personalizing advertisements

105. What aspect of AI helps detect crop diseases?
(A) Natural Language Processing (B) Computer Vision
(C) Expert Systems (D) Algorithmic Trading

106. Which AI subfield is inspired by the human brain?
(A) Robotics (B) Deep Learning
(C) NLP (D) Symbolic Reasoning

107. What is a common application of AI in gaming?
(A) Disease detection (B) Creating realistic characters
(C) Predicting crop yields (D) Algorithmic trading

10.2 AI ALGORITHMS AND TECHNIQUES

LONG QUESTION

Q.1 What are the two main categories of AI algorithms, and how do they differ in terms of interpretability and transparency?

Ans: AI algorithms can be broadly classified into two categories based on their interpretability: **Explainable (Whitebox) Algorithms** and **Unexplainable (Blackbox) Algorithms**. The primary difference lies in the transparency of the decision-making process.

Explainable (Whitebox) Algorithms:

Explainable or whitebox algorithms are designed in a way that their decision-making process is transparent and understandable. Users can easily follow how a decision was made and can track the sequence of steps leading to a conclusion.

Examples and Applications:

Decision Trees: A decision tree is a tool that helps machines make decisions by answering a series of questions, where each question leads to another question or a final decision. It resembles

a flowchart and is often used in scenarios where decisions need to be based on multiple factors.

Linear Regression: Linear regression is used to analyze the relationship between two variables. For example, it can help predict the expected grades based on the number of hours a student studies. The algorithm fits a straight line to the data points, showing how study time influences grades, making it easy to plan for optimal study strategies.

Rule-Based Systems: These systems operate based on a set of predefined "if-then" rules. The computer follows these rules to make decisions in various situations. For example, in a game, rules like "if the character is about to hit an obstacle, then jump" are applied to ensure smooth gameplay.

Q.2 What are unexplainable (blackbox) AI algorithms, and how do they differ from explainable algorithms?

Ans: Unexplainable or **blackbox algorithms** are AI models whose decision-making process is difficult to interpret or understand. Unlike explainable (whitebox) algorithms, blackbox algorithms involve complex computations and interactions that make it challenging to trace how a particular decision was made.

Unexplainable (Blackbox) Algorithms:

Blackbox algorithms are complex models that generate results without providing a clear or understandable explanation of the reasoning behind those results. The process within the algorithm is not transparent, and even experts may find it hard to interpret how specific conclusions or decisions were reached.

Characteristics and Challenges:

Complexity: Blackbox algorithms often rely on intricate structures and large datasets that involve numerous computations. The decision-making process is highly non-linear, making it difficult to deconstruct the steps leading to the output.

Opacity: Since the internal workings of these models are not easily understandable, they are often referred to as "blackboxes." This lack of interpretability can be a drawback in fields where decision transparency is critical, such as healthcare or finance.

Examples:

Neural Networks: Neural networks are a prime example of blackbox algorithms. These networks consist of layers of nodes that process information in ways that are not always directly understandable by humans. They are highly effective in tasks such as image recognition, but it is difficult to explain exactly how the network reaches its conclusions.

Deep Learning Models: Deep learning models are built on neural networks and are designed to recognize patterns in large amounts of data. While they can achieve high levels of accuracy, their internal workings are often obscure, making it hard to interpret how they arrive at specific outputs.

SHORT QUESTIONS

Q.2 What is Artificial Intelligence (AI)?

Ans: **ARTIFICIAL INTELLIGENCE (AI)**

Artificial Intelligence (AI) refers to the use of algorithms and techniques that enable machines to perform tasks requiring human intelligence, such as decision-making, problem-solving, and learning.

Q.3 Why are AI algorithms important?

Ans: **AI ALGORITHMS IMPORTANTANCE**

AI algorithms are important because they help machines perform tasks efficiently, automate processes, and solve complex problems in fields like healthcare, finance, and gaming.

Q.4 What are the two types of AI algorithms based on interpretability?

Ans: **TYPES OF AI ALGORITHMS**

Explainable (Whitebox) Algorithms: Transparent and interpretable.

Unexplainable (Blackbox) Algorithms: Complex and not easily interpretable.

Q.5 What are explainable algorithms?

Ans: **EXPLAINABLE ALGORITHMS**

Explainable algorithms, also known as whitebox algorithms, are those where the decision-making process is transparent, allowing users to understand how decisions are made.

Q.6 What is a decision tree in AI?

Ans: **DECISION TREE IN AI**

A decision tree is an explainable AI algorithm that uses a series of questions to make decisions, resembling a flowchart where each question leads to another or a final decision.

Q.7 How does linear regression work?

Ans: **LINEAR REGRESSION WORK**

Linear regression models the relationship between two features by finding a straight line that best fits the data points, such as predicting grades based on study hours.

Q.8 Give an example of linear regression in real life.

Ans: **LINEAR REGRESSION IN REAL LIFE**

If a student tracks their study hours and grades, linear regression can predict future grades based on the number of hours studied.

Q.9 What are rule-based systems in AI?

Ans: **RULE-BASED SYSTEMS IN AI**

Rule-based systems use "if-then" rules written by humans to guide a computer's decision-making in specific situations, such as a game character avoiding obstacles.

Q.10 Where are explainable algorithms particularly useful?

Ans: **EXPLAINABLE ALGORITHMS**

Explainable algorithms are useful in fields like healthcare and finance, where transparency and accountability in decision-making are essential.

Q.11 What are unexplainable algorithms?

Ans: **UNEXPLAINABLE ALGORITHMS**

Unexplainable algorithms, or blackbox algorithms, are complex models where the decision-making process is not easily interpretable due to intricate computations and interactions.

Q.12 Why are blackbox algorithms challenging to understand?

Ans: **BLACKBOX ALGORITHMS CHALLENGING TO UNDERSTAND**

Blackbox algorithms are challenging to understand because their decision-making process involves complex computations, making it difficult to trace or interpret individual decisions.

Q.13 What is an example of a blackbox algorithm?

Ans: **BLACKBOX ALGORITHM**

Neural networks and deep learning models are examples of blackbox algorithms, as their processes involve intricate layers of computation.

Q.14 What is the significance of AlphaGo in AI history?

Ans: **SIGNIFICANCE OF ALPHAGO IN AI HISTORY**

AlphaGo, a reinforcement learning model, made history by defeating a world champion in the complex game of Go, showcasing the potential of AI in mastering intricate tasks.

Q.15 What role do explainable algorithms play in healthcare?

Ans: **EXPLAINABLE ALGORITHMS PLAY IN HEALTHCARE**

In healthcare, explainable algorithms ensure that medical professionals can understand AI-driven decisions, improving trust, accountability, and patient safety.

Q.16 How do rule-based systems assist in gaming?

Ans: **RULE-BASED SYSTEMS ASSIST IN GAMING**

Rule-based systems guide game characters using "if-then" rules, such as "if the character is near an obstacle, then jump," ensuring smooth navigation.

What is the relationship between study hours and grades in linear regression?

Ans: **STUDY HOURS AND GRADES IN LINEAR REGRESSION**

Linear regression shows that an increase in study hours generally leads to higher grades by finding a line that best fits the data points.

Q.17 How are decisions made in decision trees?

Ans: **DECISIONS MADE IN DECISION TREES**

Decisions in decision trees are made by asking a series of questions, where each answer leads to another question or a final decision.

Q.18 What is reinforcement learning?

Ans: **REINFORCEMENT LEARNING**

Reinforcement learning is a type of AI where models learn to make decisions by receiving rewards or penalties for specific actions, as seen in AlphaGo.

Q.19 Why is transparency crucial in AI algorithms?

Ans: **TRANSPARENCY CRUCIAL IN AI ALGORITHMS**

Transparency is crucial in AI algorithms because it builds trust, ensures accountability, and allows users to understand and validate decisions, especially in sensitive fields.

Q.20 What makes blackbox algorithms powerful despite their complexity?

Ans: **BLACKBOX**

Blackbox algorithms are powerful because they handle complex tasks, such as image recognition and strategy-based games, by leveraging advanced computations and vast data processing capabilities.

MULTIPLE CHOICE QUESTIONS

1. What is the purpose of Artificial Intelligence (AI)?
(A) To replace humans (B) To perform tasks requiring human intelligence
(C) To destroy machines (D) To follow random commands

2. What are the two types of AI algorithms based on interpretability?
(A) Transparent and opaque (B) Explainable and unexplainable
(C) Linear and non-linear (D) Machine and human algorithms

3. Which of the following is an example of an explainable AI algorithm?
(A) Neural networks (B) Decision trees
(C) Reinforcement learning (D) Deep learning

4. What does a decision tree use to make decisions?
(A) Complex computations (B) A series of questions
(C) Random choices (D) Neural nodes

5. What type of algorithm is Linear Regression?
(A) Explainable (B) Unexplainable
(C) Blackbox (D) Machine code

6. What is the purpose of rule-based systems?
(A) To make random decisions (B) To follow "if-then" rules
(C) To replace humans (D) To interpret neural networks

7. In which fields are explainable AI algorithms particularly important?
(A) Entertainment and gaming (B) Healthcare and finance
(C) Agriculture and transport (D) Sports and music

8. What is the characteristic of blackbox algorithms?
(A) Easily interpretable (B) Transparent decision-making
(C) Complex computations (D) Written by humans

9. Which AI model defeated a world champion in the game of Go?
(A) Decision Tree (B) AlphaGo
(C) Linear Regression (D) Rule-Based System

10. What does linear regression find?
(A) Complex interactions (B) A line showing relationships between features
(C) Random prediction (D) Game-winning strategies

11. What is the primary advantage of explainable AI?
(A) Faster decision-making (B) Transparency in decision-making
(C) More complex models (D) Requires no human intervention

12. Which of the following is NOT an explainable AI algorithm?
(A) Rule-based systems (B) Neural networks
(C) Decision trees (D) Linear regression

13. What helps predict grades based on study hours?
(A) Reinforcement learning (B) Linear regression
(C) Decision tree (D) Rule-based system

14. What are the rules in rule-based systems written by?
(A) Machines (B) Humans
(C) Neural networks (D) Decision trees

15. Which AI model uses reinforcement learning?
(A) AlphaGo (B) Decision tree
(C) Rule-based system (D) Linear regression

16. What does an "if-then" rule represent?
(A) Random logic (B) A decision-making system
(C) A complex model (D) An unexplainable process

17. What is the key characteristic of blackbox algorithms?
(A) Simple processes (B) Easily understood decision-making
(C) Lack of interpretability (D) Use of rule-based systems

18. Where is transparency crucial for AI algorithms?
(A) Sports predictions (B) Online gaming
(C) Healthcare operations (D) Streaming platforms

19. What type of AI algorithm is used in AlphaGo?
(A) Explainable (B) Unexplainable
(C) Rule-based (D) Decision tree

20. Which AI algorithm resembles a flowchart?
(A) Decision tree (B) Neural network
(C) Rule-based system (D) Linear regression

10.3 INTRODUCTION TO INTERNET OF THINGS

LONG QUESTIONS

Q.1 Explain the components of IoT systems and their significance in enabling connected environments. Provide examples to support your explanation.

Ans: IoT (Internet of Things) systems consist of several key components that work together to enable devices to collect, analyze, and share data over the internet. These components play a crucial role in creating connected environments that improve efficiency and provide innovative solutions.

Components of IoT Systems

Sensors:

Sensors are devices that detect and measure physical properties like temperature, humidity, light, and motion. They are the primary source of data in an IoT system.

Significance:

Sensors provide the raw data needed for analysis and decision-making.

Example:

In a smart home, temperature sensors measure room temperature to adjust the thermostat accordingly.

Actuators:

Actuators act on the data collected by sensors by converting energy into motion or performing specific actions.

Significance:

Actuators enable IoT systems to take physical actions based on analyzed data.

Example:

A smart irrigation system uses actuators to open or close water valves based on soil moisture levels.

Devices:

Devices in IoT are the physical objects, such as smartwatches, refrigerators, or vehicles, connected to the internet to perform specific tasks.

Significance:

Devices integrate sensors and actuators to interact with their environment and execute tasks.

Example:

A smart refrigerator monitors its contents and sends alerts when items need restocking.

Networks:

Networks provide the communication pathways that connect IoT devices to the internet and allow them to exchange data. These can be wired or wireless.

Significance:

Networks ensure seamless data transfer and connectivity between IoT devices.

Example:

Wi-Fi networks connect smart doorbells to mobile phones for remote monitoring.

Data Analysis:

Data analysis involves processing and interpreting the data collected by sensors to generate actionable insights.

Significance:

Data analysis helps IoT systems make intelligent decisions and improve performance.

Example:

A fitness tracker analyzes activity data to recommend personalized health goals.

Importance of IoT Components in Connected Environments

IoT components enable the seamless integration of the physical and digital worlds, allowing for efficient data collection, analysis, and action.

In healthcare, IoT devices like patient monitors track vital signs and alert healthcare providers during emergencies.

In agriculture, IoT sensors monitor soil conditions and automate irrigation to conserve water and increase productivity.

In transportation, real-time tracking systems improve efficiency and safety by optimizing traffic flow and providing accurate ETAs.

Q.2 Discuss the applications of IoT in healthcare and transportation. Include examples and explain how IoT impacts these domains.

Ans: The Internet of Things (IoT) has revolutionized various domains, including healthcare and transportation. By connecting devices and systems, IoT improves efficiency, enhances safety, and provides innovative solutions.

IoT in Healthcare

IoT has transformed healthcare by enabling better patient care, monitoring, and management.

Applications in Healthcare:

Patient Monitoring: IoT devices continuously track vital signs like heart rate, blood pressure, and glucose levels.

Medication Reminders:

IoT systems notify patients when it's time to take their medication.

Emergency Alerts:

IoT devices can alert healthcare providers during critical situations, such as irregular heart rhythms.

Examples:

A wearable fitness tracker monitors heart rate and sends alerts when abnormal patterns are detected.

IoT-enabled glucose monitors help diabetic patients maintain healthy blood sugar levels by providing real-time feedback.

Impact on Healthcare:

Improved patient outcomes through continuous monitoring and timely interventions.

Enhanced efficiency in healthcare systems by automating routine tasks.

Greater accessibility to healthcare services through remote monitoring.

IoT in Transportation

IoT enhances transportation systems by improving safety, efficiency, and connectivity.

Applications in Transportation:

Connected Vehicles: IoT enables communication between vehicles and infrastructure for real-time updates and safety alerts.

Smart Traffic Management: IoT optimizes traffic flow using smart signals and monitoring systems.

Real-Time Tracking: IoT provides accurate location tracking for public transportation and logistics.

Examples:

Smart traffic lights adjust timings based on traffic density, reducing congestion.

Fleet management systems use IoT to monitor vehicle locations, fuel efficiency, and maintenance needs.

Impact on Transportation:

Increased safety through advanced warning systems for drivers and pedestrians.

Reduced traffic congestion and fuel consumption through optimized routing.

Enhanced customer experience with real-time updates on transit schedules and delays.

SHORT QUESTIONS

Q.1 What is the Internet of Things (IoT)?

Ans:

INTERNET OF THINGS (IOT)

IoT refers to a network of physical objects or "things" that are equipped with sensors, software, and other technologies to connect and exchange data over the internet.

Example: A smart home system where lights and temperature control are managed through internet-connected devices.

What are the key components of IoT?

Ans:

KEY COMPONENTS OF IOT

The main components of IoT include:

Sensors: Collect data from the environment.

Actuators: Convert energy into motion based on data.

Devices: Everyday objects like smartwatches or cars connected to the internet.

Networks: Communication pathways for data transfer.

Data Analysis: Processing and interpreting the collected data.

Example: In a smart home, sensors detect motion, devices act, and data analysis adjusts settings.

Q.2 Why is IoT significant?

Ans:

IoT SIGNIFICANT

IoT seamlessly integrates the physical and digital worlds, enabling devices to collect, share, and analyze data. This improves efficiency, provides better services, and creates new opportunities in various sectors.

Example: Smart traffic lights optimize traffic flow based on real-time data.

Q.3 What is the role of sensors in IoT?

Ans:

ROLE OF SENSORS IN IoT

Sensors detect and measure physical properties like temperature, light, or motion and collect data from the environment.

Example:

A temperature sensor in a smart thermostat measures room temperature and sends data to adjust heating or cooling.

Q.4 How do actuators work in IoT systems?

Ans: Actuators act on data received from sensors, converting energy into motion to generate an output. Example: In a smart irrigation system, actuators open or close valves to water crops based on soil moisture levels.

Q.5 What types of devices are part of IoT?

Ans:

DEVICES PART OF IoT

IoT devices include everyday objects like smartwatches, refrigerators, and cars connected to the internet to perform specific tasks.

Example:

A smartwatch tracks steps and heart rate and sends data to a mobile app.

Q.6 How do networks function in IoT?

Ans:

NETWORKS FUNCTION IN IoT

Networks provide the communication pathways for connecting sensors and devices to the internet, allowing data sharing.

Example:

Wi-Fi connects a smart doorbell to your phone, enabling remote monitoring.

Q.7 Why is data analysis important in IoT?

Ans:

DATA ANALYSIS IMPORTANTANCE IN IoT

Data analysis processes the data collected by sensors to generate insights and make decisions. Example: A fitness tracker analyzes activity data to recommend personalized workout plans.

Q.8 What is an example of IoT in healthcare?

Ans:

EXAMPLE OF IoT IN HEALTHCARE

IoT devices in healthcare monitor patient health, track vital signs, and alert healthcare providers during emergencies.

Example:

A heart monitor alerts doctors if it detects irregularities.

Q.9 How does IoT improve transportation?

Ans:

IoT IMPROVE TRANSPORTATION

IoT enhances transportation by connecting vehicles and traffic systems to improve safety and efficiency.

Example:

Real-time tracking systems provide accurate bus arrival times.

Q.10 What is a smart home system in IoT?

Ans:

SMART HOME SYSTEM IN IoT

A smart home system uses IoT devices to automate tasks like lighting, temperature control, and security.

Example:

Smart lights turn off automatically when no one is in the room.

Q.11 Why are strong passwords important for IoT devices?

Ans:

STRONG PASSWORDS IMPORTANT FOR IoT DEVICES

Strong passwords prevent unauthorized access and protect the personal data stored in IoT devices.

Example:

A smart lock secured with a strong password ensures only authorized users can enter.

Q.12 How does IoT ensure energy efficiency?

Ans:

IoT ENSURE ENERGY EFFICIENCY

IoT devices optimize energy use by automating systems like lighting and heating based on real-time data.

Example:

Smart thermostats lower heating when the house is unoccupied.

Q.13 What are the security challenges of IoT?

Ans:

SECURITY CHALLENGES OF IoT

IoT faces challenges like data breaches, hacking, and unauthorized access, which compromise security and privacy.

Example:

Hacking into a smart home system could allow control over connected devices.

Q.14 What is encryption in IoT?

Ans:

ENCRYPTION IN IoT

Encryption secures data by converting it into unreadable code during transmission, protecting it from hackers.

Example:

Data from a smart camera to a mobile app is encrypted for privacy.

Q.15 How does regular updating benefit IoT devices?

Ans:

REGULAR UPDATING BENEFIT IoT DEVICES

Regular updates fix vulnerabilities, enhance security, and ensure optimal performance.

Example: Updating a smart TV prevents it from being affected by malware.

Q.16 How is IoT used in agriculture?

Ans:

IoT USED IN AGRICULTURE

IoT automates farming by monitoring environmental factors like soil moisture and weather conditions to optimize resources.

Example:

Sensors trigger irrigation only when needed, conserving water.

Q.17 What are the privacy concerns of IoT in healthcare?

Ans:

PRIVACY CONCERNS OF IoT IN HEALTHCARE

IoT devices collect sensitive health data, and breaches can expose personal medical records.

Example: Unauthorized access to a patient's health tracker could reveal private medical history.

Q.18 How does IoT help in environmental conservation?

Ans:

ENVIRONMENTAL CONSERVATION

IoT reduces waste and optimizes resource use, promoting sustainability.

Example: Smart water meters detect leaks and save water.

Q.19 What is the global significance of IoT?

Ans:

GLOBAL SIGNIFICANCE OF IoT

With over 20 billion devices by 2020, IoT has transformed industries by improving efficiency, connectivity, and innovation.

Example:

Smart city projects optimize energy, traffic, and waste management systems.

MULTIPLE CHOICE QUESTIONS

1. What is IoT?

(A) A software development method
(B) A network of connected physical objects
(C) A social media platform
(D) A type of wireless technology

2. Which component of IoT collects data from the environment?

(A) Actuators
(B) Sensors
(C) Networks
(D) Devices

3. What do actuators do in an IoT system?
(A) Detect motion
(B) Convert energy into motion
(C) Store data
(D) Transmit data wirelessly

4. What is an example of an IoT device?
(A) Refrigerator
(B) Laptop
(C) Television
(D) All of the above

5. What is the main function of networks in IoT?
(A) Collect data
(B) Analyze data
(C) Connect devices to the internet
(D) Manufacture devices

6. Where can data analysis in IoT take place?
(A) Only on devices
(B) Only in the cloud
(C) Either on devices, in the cloud, or on a central server
(D) None of the above

7. What is an example of IoT in healthcare?
(A) Smart traffic lights
(B) Patient monitoring devices
(C) Temperature control systems
(D) Cloud storage

8. Why are smart home systems considered an IoT application?
(A) They control lighting and temperature manually
(B) They use internet-connected appliances to automate tasks
(C) They store data offline
(D) They are not considered an IoT application

9. What is a major privacy concern with IoT devices?
(A) High cost of devices
(B) Data breaches
(C) Limited battery life
(D) Limited availability of devices

10. What is the role of encryption in IoT?
(A) To compress data
(B) To protect transmitted data
(C) To connect devices to networks
(D) To update software

11. What should be done to keep IoT devices secure?
(A) Use weak passwords
(B) Avoid updating the software
(C) Use strong passwords and regular update
(D) Turn off devices when not in use

12. What is an example of IoT in transportation?
(A) Manual traffic signals
(B) Real-time tracking systems
(C) Offline navigation systems
(D) Basic GPS devices

13. How does IoT contribute to energy efficiency?
(A) By using non-renewable energy
(B) By reducing automation
(C) By monitoring and optimizing energy usage
(D) By disconnecting from the internet

14. What is a key feature of IoT devices?
(A) Standalone operation
(B) Internet connectivity
(C) Inability to communicate
(D) Manual data collection

15. What kind of data do sensors collect in IoT systems?
(A) Only temperature data
(B) Physical properties like light, motion, and humidity
(C) Financial data
(D) Social media trends

What is the importance of using IoT devices from reputable manufacturers?
(A) They are cheaper
(B) They ensure better security and regular updates
(C) They are compatible with all devices
(D) They do not require internet connectivity

16. **What is the significance of IoT?**
(A) It enables seamless integration of physical and digital worlds
(B) It operates only offline
(C) It replaces traditional networks
(D) It collects data without sharing it

17. **How can IoT improve agriculture?**
(A) By monitoring soil conditions and automating irrigation
(B) By reducing crop yield
(C) By eliminating sensors
(D) By disconnecting from networks

18. **Which component of IoT converts data into actionable results?**
(A) Networks (B) Sensors
(C) Actuators (D) Devices

19. **What was the number of IoT devices in 2020?**
(A) 10 million (B) 20 billion
(C) 50 million (D) 5 billion

10.4 IMPLICATIONS AND FUTURE OF EMERGING TECHNOLOGIES

LONG QUESTION

Q.1 What are the potential risks and challenges associated with the rapid adoption of Artificial Intelligence (AI) and the Internet of Things (IoT)?

Ans: The rapid adoption of Artificial Intelligence (AI) and the Internet of Things (IoT) brings numerous benefits but also presents significant risks and challenges. These concerns must be carefully considered to maximize the positive impact of these technologies.

Risks and Challenges:

Data Privacy:

AI and IoT devices collect vast amounts of personal and sensitive data. The extensive data collection by these technologies raises concerns about data privacy. Unauthorized access to or misuse of this data could lead to privacy violations, identity theft, and exploitation.

Mitigation Strategies: Ensuring data privacy requires robust security measures, including encryption, secure authentication, and regular updates to protect data from breaches and unauthorized access. Comprehensive data protection laws, such as the General Data Protection Regulation (GDPR) in Europe, play a crucial role in safeguarding personal information.

Algorithmic Bias:

AI systems are trained using large datasets, and if these datasets contain biases, AI models can perpetuate or even amplify these biases. This can result in unfair outcomes in areas like hiring, law enforcement, and lending practices.

Mitigation Strategies: To address algorithmic bias, it is essential to analyze training data for inherent biases and implement techniques to mitigate them. This includes ensuring that data collection is diverse and representative and applying methods for bias detection and correction.

Policy and Regulatory Frameworks:

To mitigate these risks, comprehensive policy and regulatory frameworks are required. These should include:

Data Protection Laws: Enforcing strict regulations like the GDPR to ensure secure data collection and processing.

Ethical Guidelines: Establishing ethical guidelines for AI development to promote fairness, transparency, and accountability.

Bias Mitigation Standards: Creating standards to detect and reduce biases in AI systems.

Security Standards for IoT: Implementing strong security protocols for IoT devices to prevent cyber-attacks.

Q.2 How do AI and IoT technologies impact daily life, work environments, and society at large? Provide detailed examples of their applications in various sectors and discuss the societal challenges these technologies aim to address.

Ans: AI and IoT are transforming various aspects of our daily lives, work environments, and society at large. These technologies offer numerous advantages, improving efficiency, convenience, and problem-solving capabilities across different sectors.

Impact on Daily Life:

AI and IoT are making everyday life more convenient and efficient. These technologies are used in smart home devices and healthcare solutions to improve quality of life.

Smart Homes: IoT devices like smart thermostats and security systems help automate home management. For example, smart thermostats adjust temperatures for energy efficiency and comfort, while security systems monitor homes for potential threats.

Healthcare: Wearable devices, such as fitness trackers, monitor health metrics like heart rate and activity levels. These devices provide real-time data to medical professionals, helping with better health management and early detection of potential health issues.

Impact on Work Environments:

In workplaces, AI and IoT are revolutionizing efficiency and productivity by automating tasks and enabling data-driven decisions.

AI in Workplaces: AI automates repetitive tasks, allowing employees to focus on more strategic activities. For example, AI tools can handle administrative tasks like scheduling and data entry, freeing up time for creative and analytical work.

IoT in Industry: IoT devices in industrial settings optimize production processes by monitoring equipment health and detecting potential failures before they occur. This leads to reduced downtime, lower maintenance costs, and more efficient operations.

Impact on Society at Large:

AI and IoT technologies hold the potential to address large-scale societal challenges, from climate change to urbanization.

Smart Cities: IoT is integral to smart city initiatives, where technologies are used to manage resources efficiently. For example, IoT sensors can monitor traffic flow to reduce congestion and optimize energy use in public lighting systems, contributing to a more sustainable and livable urban environment.

Healthcare Accessibility: AI and IoT also help improve healthcare access, especially in underserved regions, by enabling remote monitoring and telemedicine. Wearable health devices can transmit real-time data to doctors, facilitating prompt medical intervention.

Climate Change: AI and IoT technologies are increasingly used to tackle climate change by monitoring environmental conditions and optimizing energy use in various sectors, from transportation to agriculture.

SHORT QUESTIONS

Q.1 What are the key risks of AI and IoT?

Ans: **THE PRIMARY RISKS INCLUDE**

Data Privacy:

The collection of large amounts of sensitive information can lead to misuse or unauthorized access.

Algorithmic Bias:

AI systems may perpetuate biases present in training datasets, leading to unfair outcomes.

Example:

In hiring, biased datasets might prioritize certain demographics, causing inequity.

Q.2 How can algorithmic bias be addressed?

Ans: **BIAS CAN BE MITIGATED BY:**

Analyzing training datasets for biases.

Collecting diverse and representative data.
Implementing bias detection techniques.
Example: In law enforcement, ensuring datasets include varied communities prevents biased profiling.

Q.3 Why are data protection laws essential?

Ans: **DATA PROTECTION LAWS ESSENTIAL**

They ensure secure collection, storage, and processing of personal data, reducing risks of breaches.
Example: The GDPR mandates secure data handling in Europe.

Q.4 What is the societal impact of smart cities using IoT?

Ans: **SOCIETAL IMPACT OF SMART CITIES USING IoT**

Smart cities manage resources efficiently, reduce congestion, and improve public services.
Example: IoT sensors in traffic lights optimize flow, reducing pollution.

Q.5 What are ethical guidelines for AI?

Ans: **ETHICAL GUIDELINES FOR AI**

Ethical guidelines ensure fairness, transparency, and accountability in AI systems.
Example: The IEEE provides frameworks for ethical AI deployment.

MULTIPLE CHOICE QUESTIONS

1. What is a primary concern associated with IoT and AI?
(A) Increased energy consumption (B) Data privacy
(C) Lack of innovation (D) Reduced internet speed

2. What can algorithmic bias in AI lead to?
(A) Faster data processing (B) Unfair outcomes
(C) Enhanced creativity (D) Increased storage requirements

3. Which regulation ensures data protection in Europe?
(A) IEEE Standards (B) Cybersecurity Act
(C) General Data Protection Regulation (GDPR) (D) Ethical Guidelines for AI

4. What role do ethical guidelines play in AI?
(A) They ensure energy efficiency.
(B) They promote fairness, transparency, and accountability.
(C) They increase data storage capacity.
(D) They enhance hardware performance.

5. Which of the following is a key security measure for IoT devices?
(A) Faster internet connection (B) Regular software updates
(C) Increased production costs (D) Minimizing device usage

6. What is a societal benefit of smart cities using IoT?
(A) Decreased use of public services (B) Increased traffic congestion
(C) Efficient resource management (D) Reduced technological advancements

7. What does bias mitigation in AI involve?
(A) Encryption of data (B) Techniques for diverse data collection
(C) Faster processing algorithms (D) Reducing hardware size

8. How does IoT enhance healthcare?
(A) By automating repetitive tasks (B) By providing real-time health data
(C) By increasing manufacturing efficiency (D) By improving transportation

9. Which field benefits from AI-enabled data-driven decision-making?
(A) Healthcare only (B) Transportation only
(C) Work environments (D) Entertainment systems

10. What is one way to protect IoT devices from cyber-attacks?
(A) Ignoring regular updates (B) Implementing encryption
(C) Increasing internet speed (D) Using outdated hardware

11. What does the IEEE provide for AI systems?
(A) Smart home solutions (B) Ethical guidelines
(C) Security software updates (D) Data privacy laws

12. What is the main focus of data protection laws?
(A) Making devices faster (B) Securing personal data
(C) Increasing cloud storage (D) Promoting AI adoption

13. What is one challenge of training AI systems on large datasets?
(A) Higher operational costs (B) Algorithmic bias
(C) Reduced decision accuracy (D) Limited dataset variety

14. Which device is an example of IoT enhancing daily life?
(A) Desktop computers (B) Wearable health monitors
(C) Typewriters (D) Landline telephones

15. What is a workplace benefit of AI?
(A) Reduced internet usage (B) Increased task automation
(C) Limited data analysis (D) Increased repetitive tasks

SUMMARY

- Artificial Intelligence (Al) refers to the simulation of human intelligence in machines that are programmed to think and learn like humans.
- Machine learning is a type of artificial intelligence where computers learn from experience and improve over time without being explicitly programmed.
- Deep learning is a special kind of machine learning. It uses complex structures called neural networks, which are inspired by how our brains work.
- Natural Language Processing, or NLP, is a technology that helps computers understand and talk to us in our own language.
- Computer vision is a field of artificial intelligence that enables computers to see and understand the visual world.
- Robotics is the science of building and programming robots. Robots are machines that can do tasks for us, like cleaning the floor or building cars.
- Al algorithms can be broadly categorized into two types based on their interpretability: explainable (whitebox) and unexplainable (blackbox) algorithms.
- Whitebox algorithms are those where the decision-making process is transparent and understandable.
- Blackbox algorithms are those where the decision-making process is not easily interpretable.
- The Internet of Things (IoT) refers to the network of physical objects- "things"-that are embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the internet.

EXERCISE

MULTIPLE CHOICE QUESTIONS

79. Which of the following is not a subfield of Al?
(A) Machine Learning (C) Computer Vision
(B) Natural Language Processing (D) Robotics

80. Which of these Al algorithms is considered an "explainable" model?
(A) Neural Networks (C) Random Forests
(B) Decision Trees (D) Convolutional Neural Networks

81. Which of these is a security concern in IoT deployments?
(A) Personalized drug development (B) Automated diagnosis
(C) Data privacy (D) All of the above

82. Which of the following is an application of Al in healthcare?
(A) Device vulnerability (C) Lack of standardization

(C) Remote patient monitoring (D) All of the above

83. What is the primary purpose of using AI techniques in machine learning models?

(A) To improve accuracy (B) To enhance interpretability

(C) To reduce computational complexity (D) All of the above

84. What is the key difference between explainable (whitebox) and unexplainable (blackbox) AI models?

(A) The complexity of the model

(B) The ability to understand the decision-making process

(C) The performance of the model

(D) The training data used

85. Which of the following is an application of IoT in the transportation domain?

(A) Smart traffic management (B) Vehicle-to-Vehicle (V2V) communication

(C) Predictive maintenance of vehicles (D) All of the above

86. Which of these is a potential impact of AI and IoT on the job market?

(A) Job displacement due to automation (B) Increased demand for specialized skills

(C) Transformation of job roles and responsibilities (D) All of the above

87. What is the key concern associated with algorithmic bias in AI-powered decision-making processes?

(A) Lack of transparency (B) Perpetuation of existing societal biases

(C) Reduced accuracy of the model (D) All of the above

88. Which of the following is an ethical principle that should be considered in the development and deployment of AI and IoT technologies?

(A) Transparency and accountability (B) Respect for privacy and data rights

(C) Fairness and non-discrimination (D) All of the above

SHORT QUESTIONS

Q. 57 Define Artificial Intelligence (AI).

Ans: Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think, learn, and perform tasks like humans. It includes subfields like machine learning, natural language processing, and robotics.

Q. 58 What is the historical context and evolution of AI?

Ans: AI was first conceptualized in 1956 at the Dartmouth Conference by John McCarthy, marking the beginning of AI research. Key milestones include the development of expert systems in the 1970s-80s, machine learning in the 1990s, and advancements in deep learning and robotics in the 2000s. Technologies like voice assistants and AI-driven models like ChatGPT have emerged in recent years.

Q. 59 Provide two examples of AI applications in healthcare.

Ans: 1. Diagnosing diseases and personalizing treatment plans.

2. Predicting patient outcomes and assisting in remote monitoring.

Q. 60 Explain the role of AI techniques in advancing machine learning models.

Ans: AI techniques, such as deep learning and neural networks, enhance the capability of machine learning models by enabling them to process vast datasets, identify patterns, and make accurate predictions. These techniques help improve the interpretability and efficiency of decision-making systems.

Q. 61 Define the Internet of Things (IoT).

Ans: IoT is a network of interconnected physical devices equipped with sensors, software, and technologies to exchange data with other devices and systems via the internet. It enables seamless communication and data sharing for enhanced efficiency.

Q. 62 Describe the significance of IoT in connecting devices and systems.

Ans: IoT integrates the physical and digital worlds, allowing devices to collect, share, and analyze data. This connectivity improves operational efficiency, enables smart services, and fosters

innovation in areas like healthcare, agriculture, and smart homes.

Q. 63 What are the potential risks associated with AI and IoT?

Ans: AI and IoT pose risks such as:
Data privacy concerns due to vast data collection.
Cybersecurity threats like hacking.
Algorithmic biases leading to unfair outcomes in decision-making.

Q. 64 Discuss the societal impact of AI and IoT on daily life.

Ans: AI and IoT enhance daily life through smart homes, efficient transportation systems, and improved healthcare. They automate repetitive tasks, optimize resource management, and enable better connectivity, contributing to convenience and productivity.

Q. 65 Explain the concept of algorithmic bias.

Ans: Algorithmic bias occurs when AI models trained on biased datasets perpetuate or amplify these biases, leading to unfair or discriminatory outcomes in areas like hiring, law enforcement, or lending. Addressing this requires careful data analysis and bias mitigation techniques.

Q. 66 Outline the importance of ethical considerations in AI and IoT.

Ans: Ethical considerations ensure fairness, transparency, and accountability in AI and IoT development. They address issues like data privacy, bias mitigation, and security, fostering trust and responsible innovation.

LONG QUESTIONS

1. **Discuss the various applications of Al in the field of education. Provide specific examples and explain how Al can enhance the educational experience.**
   See Topic 10.1
2. **Differentiate between explainable (whitebox) and unexplainable (blackbox) Al models.**
   See Topic 10.2
3. **Describe the components of an loT system. Explain how these components work together to enable loT applications.**
   See Topic 10.3
4. **Explore the applications of loT in the transportation domain.**
   See Topic 10.3
5. **Analyze the potential privacy concerns associated with loT deployments.**
   See Topic 10.3
6. **Evaluate the impact of Al and lot on the job market and work environments.**
   See Topic 10.4
7. **Explain the role of policy and regulatory frameworks in addressing the challenges of Al and loT. Provide examples of existing frameworks and discuss their effectiveness.**
   See Topic 10.4
8. **Describe the concept of algorithmic bias and its implications in Al- powered decision-making processes. Suggest strategies to mitigate the risks of algorithmic bias.**
   See Topic 10.4
9. **Develop a set of ethical principles and guidelines for the responsible development and deployment of Al and loT technologies.**
   See Topic 10.4

ANSWER KEYS

TOPIC 10.1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

1	A	**2**	B	**3**	B	**4**	C	**5**	B
6	C	**7**	C	**8**	C	**9**	C	**10**	B
11	A	**12**	C	**13**	C	**14**	A	**15**	C
16	B	**17**	B	**18**	B	**19**	B	**20**	B

TOPIC 10.2 AI ALGORITHMS AND TECHNIQUES

1	B	**2**	B	**3**	B	**4**	B	**5**	A
6	B	**7**	B	**8**	C	**9**	B	**10**	B
11	B	**12**	B	**13**	B	**14**	B	**15**	A
16	B	**17**	C	**18**	C	**19**	B	**20**	A

TOPIC 10.3 INTRODUCTION TO INTERNET OF THINGS (IOT)

1	B	**2**	B	**3**	B	**4**	A	**5**	C
6	C	**7**	B	**8**	B	**9**	B	**10**	B
11	C	**12**	B	**13**	C	**14**	B	**15**	B
16	B	**17**	A	**18**	A	**19**	C	**20**	B

TOPIC 10.4 IMPLICATIONS AND FUTURE OF EMERGING TECHNOLOGIES

1	B	**2**	B	**3**	C	**4**	B	**5**	B
6	C	**7**	B	**8**	B	**9**	C	**10**	B
11	B	**12**	B	**13**	B	**14**	B	**15**	B

TEXTBOOK EXERCISE MCQs

1	D	**2**	B	**3**	D	**4**	D	**5**	D
6	B	**7**	D	**8**	D	**9**	D	**10**	D