CH1

Revisiting AI Project

Q1. What is the purpose of defining the problem statement during the Problem Scoping stage in an AI project cycle?

A) To collect data ✔■ B) To understand the aim and objective of the project C) To train the model D) To process data

Q2. In what ways can AI models be categorized based on the type of data fed into them?

A) Two domains B) Four domains C) Three domains ✔■ D) Five domains

Q3. In Statistical Data, what is the primary function of the system in relation to data?

A) Generating large datasets ✔■ B) Analyzing data to extract insights C) Converting data into images D) Distributing data across networks

Q4. What is the main goal of Computer Vision projects?

A) Translating audio data into visual descriptions B) Converting digital data into analogue signals C) Teaching machines to understand textual information ✔■ D) Converting digital visual data into computer-readable language

Q5. What is the primary focus of NLP?

A) Analyzing computer languages B) Interacting between computers and humans using artificial language ✔■ C) Dealing with the interaction between computers and humans using natural language D) Enhancing human-to-human communication

Q6. How are Ethical Frameworks for AI categorized?

A) Into legal and illegal frameworks ✔■ B) Into rights-based and value-based frameworks C) Into historical and contemporary frameworks D) Into theoretical and practical frameworks

Q7. What is the central focus of virtue-based value-based frameworks?

A) Maximizing utility B) Protecting human rights ✔■ C) Aligning actions with ethical principles and beliefs D) Ensuring compliance with legal regulations

Q8. Which of the following best describes rights-based value-based frameworks?

✔■ A) Prioritizing human rights and dignity, valuing human life over other considerations B) Evaluating actions based on maximizing overall good and minimizing harm C) Centering on the character of the decision-maker and the alignment of actions with personal or societal virtues D) Focusing on achieving outcomes that offer the greatest benefit

Q9. What is the primary domain of application for Bioethics?

A) Agriculture ✔■ B) Healthcare and life sciences C) Information technology D) Environmental conservation

Q10. Assertion & Reasoning (Ethics)

Assertion: Ethics provide guidance in distinguishing right from wrong. Reasoning: Ethics consist of a set of values and morals that aid individuals in making moral judgments and decisions.

✔■ A) Both Assertion and Reasoning are true, and Reasoning is the correct explanation of the Assertion. B) Assertion is true, but Reasoning is false. C) Both Assertion and Reasoning are true, but Reasoning is not the correct explanation of the Assertion. D) Assertion is false, but Reasoning is true.

Reflection Time – Long Answer Questions (Well Explained)

1. Outline the main steps in the AI Project Cycle briefly.

The AI Project Cycle helps us build an AI solution in a structured way. The main steps are:

Problem Scoping – Understand the real-world problem. Ask: What are we trying to solve?

Data Acquisition – Collect the right type of data related to the problem.

Data Exploration – Clean and analyze the data to find patterns or trends.

Modelling – Train the AI model using algorithms and data.

Evaluation – Test the model to check its performance and accuracy.

■ Tip for exams: Remember these 5 steps with the phrase "Please Do Data Modelling Effectively."

2. What roles does computer vision play in agricultural monitoring systems?

Computer vision helps farmers and scientists in many smart ways:

■ Disease Detection – By taking pictures of leaves and identifying signs of diseases early.

■ Crop Monitoring – Drones and cameras can track crop growth, health, and coverage.

■ Soil Analysis – Computer vision helps in examining soil texture and moisture.

■ Livestock Counting – Helps in monitoring and counting animals using video footage.

■ Weed Detection – It can distinguish weeds from crops to help with spraying accurately.

This makes farming more accurate, less labor-intensive, and technology-driven.

3. Mention the factors which knowingly or unknowingly influence our decision-making.

Our decisions are often affected by:

Emotions – Sometimes we choose based on how we feel rather than logic.

Personal values and beliefs – What we believe to be right or wrong influences our choices.

Cultural background – Traditions or customs can impact decisions.

Peer pressure or social influence – What others expect or think can affect us.

Past experiences – Previous successes or failures guide our current choices.

That’s why we must be aware and responsible, especially while working with AI systems.

4. What is the necessity for Ethical Frameworks in AI development?

Ethical frameworks are needed in AI because:

They guide developers to make fair and just decisions.

They prevent bias, discrimination, or harm to people.

They protect user privacy and safety.

They promote trust and accountability in AI systems.

They help ensure AI is used for good and not for exploitation.

In short, ethical frameworks make AI more human-friendly, safe, and responsible.

5. Mention the key characteristics of sector-based frameworks.

Sector-based frameworks are special rules made for different fields. Their key features:

■ Field-Specific – Designed for areas like healthcare, education, agriculture, etc.

■■ Regulation-Based – Follow industry laws and standards.

■ Expert-Guided – Built with input from domain experts.

■ Focused on Risk and Ethics – Aim to reduce risks and ensure ethical use.

■ Updated Regularly – Evolve with new tech and challenges.

They help make sure AI is used safely and effectively in each specific field.

6. What do you mean by Bioethics?

Bioethics is the study of ethical issues in healthcare, medicine, and life sciences.

It deals with questions like:

Should AI be allowed to make decisions during surgeries?

Is it right to use human data for experiments without permission?

Who is responsible if a robot makes a mistake during treatment?

It helps doctors, scientists, and engineers make decisions that are not just smart but also morally right and human-focused.

7. What is Natural Language Processing? Explain any two real-life applications.

Natural Language Processing (NLP) is a field of AI that helps computers understand and use human language (like English, Hindi, etc.).

■ It allows machines to read, listen, speak, and reply like a human.

Two real-life applications:

Chatbots – Used in customer support (like on websites or apps) to answer user queries.

Voice Assistants – Tools like Alexa, Siri, or Google Assistant that understand voice commands and respond.

NLP makes it easier for humans to communicate with machines in their own language.

8. How do value-based frameworks contribute to ethical decision-making by emphasizing fundamental principles and values?

Value-based frameworks focus on universal moral values like honesty, fairness, respect, and justice.

They help in ethical decision-making by:

Guiding choices based on what is morally right, not just useful.

Preventing actions that harm people, even if they give high profits.

Encouraging respect for human dignity and equality.

Helping developers and AI teams act responsibly and transparently.

Such frameworks build trust in AI and make sure technology serves human values.

Ch2

Advanced Concepts of Modelling in AI

1. In which type of machine learning is the data labeled with the classified output? a) Supervised Learning ■ b) Unsupervised Learning c) Reinforcement Learning d) Deep Learning

2. An email spam filter that learns to identify spam emails based on labeled examples is an application of: a) Supervised Learning ■ b) Unsupervised Learning c) Reinforcement Learning d) Deep Learning

3. A machine learning algorithm that groups similar customer purchases into clusters for recommendation systems uses: a) Supervised Learning b) Unsupervised Learning ■ c) Reinforcement Learning d) Transfer Learning

4. An AI agent playing a game and learning from its rewards and penalties is an example of: a) Supervised Learning b) Unsupervised Learning c) Reinforcement Learning ■ d) Evolutionary Learning

5. Which of the following statements is NOT true about unsupervised learning? a) It helps in pattern recognition b) It is used in clustering and segmentation tasks c) Drives used for market segmentation applications d) Develop complex neural network architectures ■

6. In unsupervised learning scenarios, the goal is to: a) Train an agent through rewards and penalties b) Learn specific outputs based on labeled data c) Learn patterns and relationships within unlabeled data ■ d) Group used to implement regression applications

7. Clustering algorithms are commonly used in unsupervised learning for: a) Stock-price prediction b) Image classification c) Data trend analysis d) Grouping similar data points ■

8. Identify the type of model (classification, regression, clustering, association) for each case:

a) A bank wants to predict whether a loan applicant will default → Answer: Classification ■

b) A real estate agency wants to predict house prices → Answer: Regression ■

c) A marketing company segments users for campaigns → Answer: Clustering ■

d) A grocery store finds items often bought together → Answer: Association ■

9. Imagine an AI playing a game and learning to win by trial and error. This is an example of: a) Supervised Learning b) Unsupervised Learning c) Reinforcement Learning ■ d) Natural Language Processing

10. Artificial neural networks are inspired by the structure and function of: a) The human brain ■ b) Human computers c) Complex mathematical models d) High-speed processors

11. The process of adjusting the weights in a neural network to improve performance is called: a) Activation b) Learning c) Optimization ■ d) Training

12. A neural network with multiple layers of interconnected neurons is called a: a) Linear Network b) Single Layer Network c) Deep Neural Network ■ d) Perceptron

13. Neural networks are particularly well-suited for tasks involving: a) Simple calculations and mathematical operations b) Recognizing patterns in complex data like images and text ■ c) Performing logical deductions and reasoning tasks d) Storing and retrieving large amounts of information

14. Training a neural network often requires: a) A small set of labeled data samples b) A significant amount of data and computational resources ■ c) A specific set of programming instructions d) A human expert to guide the learning process

Q2. Difference between Classification and Regression (with examples)

Simple Explanation:

Classification is when the computer tells us what group something belongs to.

Regression is when the computer predicts a number.

Table to remember easily:

■ Tip to remember:

Classification → "Class" or category

Regression → "Result" as number

■ Q3. What is supervised, unsupervised, and reinforcement learning? Give examples.

■ These are 3 types of machine learning. Think of them like 3 different ways a student can learn.

1. Supervised Learning:

Like a teacher teaching students with answers. We give the computer data with correct answers, so it learns from it.

■ Example: If we give data like:

Study Hours: 2 → Marks: 50

Study Hours: 4 → Marks: 80 Then it learns and can guess marks for 3 hours.

■ Use when: Answers are already known.

2. Unsupervised Learning:

■ Like learning without a teacher. The computer gets data without answers. It finds patterns or groups by itself.

■ Example: A shopping app sees what people buy and groups them — like "sports lovers", "gadget lovers" — without being told.

■ Use when: We don’t have labels.

3. Reinforcement Learning:

■ Like learning by playing a game. The computer learns by trying, and gets rewards for good work.

■ Example: A robot tries walking. If it does well, it gets a reward (points). If it falls, it gets no points. It learns to walk over time.

■ Use when: Learning by reward and trial.

■ Q4. What is clustering and how is it different from classification?

Clustering and classification are both about grouping things, but how they group is different.

Classification:

We already know the groups.

Computer puts items into those groups.

■ Like sorting fruits into “apple” and “banana”.

■ Example: Classify emails into “spam” and “not spam”.

■ Clustering:

We don’t know the groups.

Computer finds the groups on its own.

■ Like a new student grouping classmates by interests (sports, music) without asking them.

■ Example: Group customers based on their shopping habits.

Simple table:

■ Q5. Case Study Questions – What type of learning is used?

a) Case Study 1: A company wants to predict which customers will leave. They already have past data of customers who left and stayed.

■ Answer: Supervised Learning ➡■ Because the company knows the answer in the data (left or stayed), so it's like teaching the computer with answers.

b) Case Study 2: A social media platform wants to group users by interest, but they don't have any labels.

■ Answer: Unsupervised Learning ➡■ Because the computer finds the groups by itself without labels.

c) Case Study 3: A game changes difficulty based on how well the player plays. It gives rewards when player does well.

Answer: Reinforcement Learning ➡■ Because the system learns through trial and reward — like a game.

8. Identify the type of model (classification, regression, clustering, association model) for each of the following case studies.

Let's go one by one:

a) A bank wants to predict whether a loan applicant will default on payments. They have past data with income, credit score, loan amount, and repayment status.

■ Model Type: Classification

Explanation (student-friendly): This is classification because the output is a label — whether the person will pay or default (Yes/No). It is based on past data with known answers.

b) A real estate agency wants to predict the selling price of houses based on various features such as size, location, number of bedrooms, and bathrooms.

■ Model Type: Regression

Explanation: The goal is to predict a price, which is a numerical value. This is a classic case of regression, because the answer is not a category but a number.

c) A marketing company wants to segment customers with different characteristics into groups for personalized advertising campaigns. They have data on buying behavior, purchase history, and amount spent.

■ Model Type: Clustering

Explanation: Here, the goal is to form groups of customers with similar behavior, and no labels are given. This is unsupervised learning, and it is called clustering.

d) A grocery store wants to identify associations between different products purchased by customers to understand which items are commonly bought together.

■ Model Type: Association Model

Explanation: This is an association model because it is used to find rules or patterns like: "If someone buys bread, they also buy butter." It finds relationships between items in a transaction.

■ Final Summary Table:

Important Points

1. What is Problem Scoping in AI Project Cycle?

Problem Scoping is the first stage of the AI Project Cycle. It means clearly understanding and defining the problem you want to solve using AI.

Key Points:

Identify the real-world problem

Understand who is affected (the stakeholders)

Set a clear goal for the AI project

Think about what success looks like

Example:

Problem: Students are not performing well in exams. Scoping:

Why is this happening?

Who is affected? (Students, Teachers, Parents)

What do we want AI to do? (Predict weak areas or suggest improvement plans)

In simple words:

Problem Scoping means asking: ➡■ What is the problem? ➡■ Why do we want to solve it? ➡■ Who will benefit from the solution?

2. What is Data Acquisition in AI Project Cycle?

Data Acquisition is the second stage of the AI Project Cycle. It means collecting the right data that is needed to solve the problem identified in the Problem Scoping stage.

Key Points:

Collect data from different sources (surveys, sensors, websites, etc.)

Make sure the data is relevant, accurate, and clean

Store the data properly for the next steps in the AI cycle

Example:

If your problem is students' low exam scores, then in Data Acquisition, you collect:

Student marks

Attendance

Study hours

Homework completion data

In simple words:Data Acquisition means gathering the useful information that your AI system needs to learn and work properly.

3. What is Data Exploration in AI Project Cycle?

Data Exploration is the third stage of the AI Project Cycle. It means studying and analyzing the collected data to understand its patterns, trends, and structure.

Key Points:

Check if the data is correct and complete

Remove any errors or missing values

Look for patterns and relationships in the data

Use charts, graphs, or summary statistics to understand the data

Example:

If you collected students' marks, attendance, and homework data, in Data Exploration, you might find:

Students with low attendance also have low marks

Those who complete homework regularly score better

In simple words:Data Exploration means looking closely at the data to find useful information that helps build a good AI model.

4.AI Modelling Approaches – Class 10 Explanation

Artificial Intelligence (AI) uses different methods to solve problems and make smart decisions. These methods are called AI Modelling Approaches.

There are mainly two important approaches for your syllabus:

1. Rule-Based Approach

What is it? In the rule-based approach, a human writes a set of rules, and the computer simply follows them. These rules are written using IF–THEN logic.

Example: If temperature is more than 37°C, then the computer will show the message: "You have a fever."

So the computer checks the condition (temperature > 37°C) and then takes the action (showing a message).

How does it work? The human provides all the knowledge in the form of rules. The computer does not learn anything on its own. It only does what it has been told by the programmer.

Where is it used?

In simple decision-making systems

In early AI applications like automatic customer support systems

In systems where decisions are always fixed, like turning on a fan if the room gets hot

Advantages of Rule-Based Approach:

It is easy to understand and explain.

Works well for small and simple problems.

Gives the same output every time for the same input.

Disadvantages of Rule-Based Approach:

The computer cannot learn new things.

It cannot handle situations that were not included in the rules.

If there are too many rules, the system becomes very complicated.

In short: This approach is like a robot that follows fixed instructions without thinking.

2. Learning-Based Approach

What is it? In the learning-based approach, the computer learns by looking at data and finding patterns — just like how a student learns by practicing questions. Instead of giving fixed rules, we give the computer examples and it learns from them.

Example: If we give the computer 1,000 images of apples and bananas (with names), it will study the shape, size, and color, and learn how to tell the difference. After learning, if we show a new fruit image, it can say whether it is an apple or a banana — based on what it learned.

How does it work?

We collect a lot of data.

The computer uses machine learning to find patterns in that data.

It can then make predictions or decisions without fixed rules.

There are three types of learning inside this approach:

Supervised Learning

Unsupervised Learning

Reinforcement Learning (You may have separate questions for these topics.)

Where is it used?

Face recognition (like unlocking phones)

Predicting exam marks based on study time

Voice assistants like Alexa or Siri

Online shopping recommendations

Advantages of Learning-Based Approach:

The computer can learn from experience and get better.

It can handle large and complex problems.

It can find hidden patterns that are difficult for humans to see.

Disadvantages of Learning-Based Approach:

It needs a large amount of data to learn properly.

It needs more powerful computers and time to train.

Sometimes it can make mistakes if the data is wrong or confusing.

In short: This approach is like a smart student who learns from examples and improves over time.

Comparison of Rule-Based and Learning-Based Approaches

5. Classification

What it means: Classification is when the machine puts things into categories or groups.

Example: You show a machine pictures of animals and ask it to say whether it’s a Cat, Dog, or Elephant.

■ Output: A label or category (e.g., “This is a Dog”)

Used for:

Email Spam or Not Spam

Fruit is Apple or Banana

Student is Pass or Fail

6. Regression

What it means: Regression is when the machine predicts a number or value.

Example: You give a machine data about a house (like size, location, rooms), and it predicts the price of the house.

■ Output: A number (e.g., “This house costs ■10,00,000”)

Used for:

Predicting marks

Predicting temperature

Predicting price of items

7.What is Supervised Learning?

Supervised learning is a type of machine learning where the model is trained using labeled data. Labeled data means that each input comes with a correct output (or answer), so the computer can learn the relationship between them.

In supervised learning, the goal is to help the machine learn from past data so it can predict the output for new, unseen data.

There are two main types of supervised learning:

Classification – When the output is a category or label. Example: Identifying if an email is spam or not spam.

Regression – When the output is a number or value. Example: Predicting the price of a house based on its size.

What do we mean by past data in supervised learning?

Past data means the training data that the machine is given in the beginning, which includes:

Inputs (features) — like size, color, marks, etc.

Correct outputs (labels) — like fruit name, pass/fail, price, etc.

What is Unsupervised Learning?

Unsupervised learning is a type of machine learning where the computer is given data without any labels. That means the machine doesn’t know the correct answers — it has to find patterns or groups in the data by itself.

Key Points:

No labeled answers are given.

The machine learns on its own.

It groups or arranges data based on similarities.

Example:

Imagine you give the machine pictures of fruits, but you don’t tell their names.

The machine looks at color, shape, size and might group them like this:

Group 1: Red and round

Group 2: Yellow and long

Group 3: Orange and round

Even though it doesn't know the names like apple or banana, it organizes similar items together.

Used For:

Customer grouping (marketing)

Grouping similar products

Detecting patterns or anomalies

8. What is Reinforcement Learning?

Reinforcement Learning is a type of machine learning where a computer (called an agent) learns by doing actions and getting feedback:

If the action is good, it gets a reward (positive feedback).

If the action is bad, it gets a penalty (negative feedback).

The agent learns through trial and error, improving its decisions over time to get more rewards.

■ Book Example Explained:

An AI-enabled driverless car is learning to drive.

If it drives safely, follows rules, and reduces pollution → it gets rewards.

If it breaks traffic rules or causes accidents → it gets penalties.

Over time, the car learns the best way to drive by trying different actions and seeing what works best.

In Simple Words:

Reinforcement learning is like teaching a robot or computer to learn from its own experiences, just like how we learn from our mistakes and rewards in real life.

1. What is a Neural Network?

Answer: A neural network is a system of algorithms that mimics the way the human brain works. It consists of interconnected layers of artificial neurons that process data and learn patterns from it.

2. What are the main components of a Neural Network?

Answer: The three main components are:

Input Layer: Receives the input data.

Hidden Layer(s): Processes data through activation functions and weights.

Output Layer: Produces the final result or prediction.

3. Define Artificial Neuron.

Answer: An artificial neuron is a mathematical model inspired by the biological neuron. It receives input, applies weights, sums the values, and passes it through an activation function to produce output.

4. What is the role of weights in a Neural Network?

Answer: Weights control the strength of the connection between neurons. They determine how much influence the input will have on the output.

5. What is the Activation Function? Why is it used?

Answer: An activation function decides whether a neuron should be activated or not. It adds non-linearity to the network, enabling it to learn complex patterns.

6. What is the difference between Biological and Artificial Neural Networks?

Answer:

Biological Neural Networks are networks of neurons in the human brain.

Artificial Neural Networks are models designed to simulate the brain's way of learning and processing data.

7. Give one real-life example where Neural Networks are used.

Answer: Neural networks are used in face recognition systems, such as those used in smartphones for unlocking using Face ID.

8. What is training in Neural Networks?

Answer: Training is the process of teaching a neural network by providing input data and correct output. The network adjusts its weights to minimize errors.

9. What are the types of Neural Networks?

Answer:

Feedforward Neural Network

Convolutional Neural Network (CNN)

Recurrent Neural Network (RNN)

10. What are the advantages of Neural Networks?

Answer:

Can learn and model complex data.

High accuracy in tasks like image and speech recognition.

Can improve over time with more data (learning).

11. Explain the structure of an Artificial Neural Network with a diagram.

Answer: An artificial neural network consists of three types of layers:

Input Layer:

It takes input from the dataset.

Each neuron in this layer represents a feature (like height, weight, etc.).

Hidden Layer(s):

It processes the inputs using weights and activation functions.

There can be one or more hidden layers depending on the complexity.

Output Layer:

It gives the final result or prediction of the network.

The number of neurons depends on the type of task (e.g., binary or multi-class classification).

Diagram:

mathematica

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Input Layer Hidden Layer Output Layer

O O O

O ----------> O ----------> O

O O O

■12. How does a neural network learn from data? Explain the process.

Answer: Neural networks learn using a process called training, which includes the following steps:

Initialization:

The network starts with random weights.

Forward Propagation:

Input data passes through the network.

Each neuron performs calculations and applies an activation function.

Loss Calculation:

The difference between the predicted output and actual output is calculated using a loss function.

Backpropagation:

The network adjusts the weights based on the error using techniques like gradient descent.

Repetition:

This process continues until the error is minimized and the model becomes accurate.

1 3. Compare Biological Neural Networks and Artificial Neural Networks.

Answer:

14. Describe any three real-life applications of Neural Networks.

Answer:

Facial Recognition: Neural networks are used in smartphones and security systems to identify faces and unlock devices.

Medical Diagnosis: They help in detecting diseases like cancer by analyzing medical images.

Self-driving Cars: Neural networks process data from sensors to make decisions like braking or turning.