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CLASS X · ARTIFICIAL INTELLIGENCE (417) · SKILL SUBJECT · CBSE BOARD EXAMINATION 2027

PART B · UNIT 1

AI Project Cycle & Ethical Frameworks

Unit Booklet · Short Notes · Board-Pattern Questions · Model Answers

Part B · 7 of 40 theory marks | 28 questions with model answers | Sonakshi Ma'am | Taught: Mon 23 Nov

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STUDENT DETAILS

NAME _____

CLASS & SECTION _____

ROLL NO. _____

UNIT FINISHED ON _____

OBJECTIVE SELF-CHECK _____ / 15

1

READ THIS FIRST · SHORT NOTES

Unit Notes

Revise the six stages of the AI project cycle and the three AI domains, then learn ethical frameworks: why AI needs them, sector-based and value-based frameworks, and the four principles of bioethics with a real case.

THIS UNIT IN THE BOARD PAPER

7 / 40

The syllabus gives Unit 1 **7 marks** of the 40. In the CBSE sample paper it gave **5 one-mark items**, **one 2-mark** question (stages of the AI project cycle) and **one 4-mark case study on bioethics** (the paper has internal choice, so the questions add up to more than 7).

SYLLABUS 2026–27 · WHAT CBSE LISTS FOR THIS UNIT

- AI project cycle: revisiting all the stages
- AI domains (Data Science, Computer Vision, NLP) and their uses
- Frameworks and the need for ethical frameworks for AI
- Types: sector-based and value-based (rights, utility, virtue)
- Bioethics and a bioethics case study
- Activity: "My Goodness" online decision game

HOW THE CBSE SKILL-SUBJECT PAPER IS SET (THEORY 50 MARKS · 2 HOURS)

1 mark
Objective: MCQ, assertion–reason, fill in the blank, true/false, match. Q1 is Part A; Q2–Q5 (answer 5 of 6 in each) are Part B.

2 marks
Short answer in **20–30 words**: two clear points. Part B: answer any 4 of 6 (Q11–Q16).

4 marks
Long answer in **50–80 words**: four points, or 2 + 2. Answer any 3 of 5 (Q17–Q21); often case-based.

Part B = 40
Objective 20 + short 8 + long 12. Part A (Employability Skills) = 10. Practical = 50.

Write in points, start each point with the key word, and stay inside the word limit. Objective answers: write the option letter **and** the answer.

1 The AI project cycle

AI project cycle: the step-by-step plan for building an AI project, from understanding the problem to putting the finished model to use.

1. **Problem Scoping** – understand and define the problem
2. **Data Acquisition** – collect the right data
3. **Data Exploration** – arrange and visualise the data to find patterns
4. **Modelling** – choose and train an AI model
5. **Evaluation** – test how well the model works
6. **Deployment** – put the model to use in the real world

It is a **cycle**: results from evaluation and deployment often send us back to improve the data or the model.

2 Stage 1 · Problem Scoping

Many AI projects start from the UN **Sustainable Development Goals** (17 goals such as No Poverty, Good Health, Quality Education). The **4Ws Problem Canvas** helps us understand the problem:

W	Question it answers
Who	Who are the **stakeholders** – the people facing the problem or affected by it?
What	What is the problem? What is the **evidence** that it exists?
Where	In what **situation, context or place** does it occur?
Why	Why should we solve it? What **benefit** will the solution give the stakeholders?

Problem statement template: Our [stakeholders] (Who) has / have a problem that [issue] (What) when / while [context] (Where). An ideal solution would [benefit] (Why).

3 Stages 2 and 3 · Data Acquisition and Exploration

- **Data acquisition:** collecting **reliable, relevant and authentic** data. It is split into **training data** (to teach the model) and **testing data** (to check it).
- **Data features:** the kinds of data needed, e.g. for predicting crop yield: rainfall, soil type, temperature.
- **Sources:** surveys, web scraping, sensors, cameras, observations, APIs, open government data (e.g. data.gov.in).
- **Ethics:** collect data only from trusted, open or permitted sources; never use people's private data without consent.
- **Data exploration:** arranging data and drawing **graphs and charts** to see patterns and trends, so we can choose the right model.

4 Stages 4–6 · Modelling, Evaluation, Deployment

Stage	What happens
Modelling	**Rule-based**: the developer writes the rules. **Learning-based**: the machine finds the rules from data (machine learning).
Evaluation	The trained model is tested on **testing data** it has not seen. Its **accuracy, precision, recall** and **F1 score** are checked.
Deployment	The model is built into an app, website or machine and used by real people. It is **monitored** and updated over time.

ONE PROJECT, SIX STAGES

An app that checks a leaf photo for crop disease: scoping (farmers lose crops) → photos of healthy and diseased leaves → explore → train a model → test on new photos → release the app to farmers.

5 The three AI domains

Domain	Works with	Uses
Data Science (Statistical Data)	numbers and tables of data	price prediction, weather forecasts, fraud detection, shopping recommendations
Computer Vision (CV)	images and videos	face unlock, self-driving cars, medical scans, traffic cameras
Natural Language Processing (NLP)	human language: text and speech	chatbots, voice assistants, translation, sentiment analysis

6 Frameworks and ethical frameworks

Framework: a set of steps or guidelines that helps us solve a problem in an organised way.

Ethical framework: a set of principles that helps us decide what is **morally right**, so that our choices do not harm people unfairly.

Why AI needs ethical frameworks:

- AI decisions affect **millions** of people at once (loans, jobs, health).
- AI learns from data, and data can carry **human bias**; the model then repeats it.
- They make developers think about **fairness, privacy, transparency** and **accountability** before harm is done.
- They build **trust** in AI systems.

ACTIVITY LINK

Our own decisions are shaped by what we value, what we know and our hidden biases. The "My Goodness" game, where you choose whom to donate to, shows how bias enters choices. AI copies such bias if we are not careful.

7 Types of ethical frameworks

1. Sector-based frameworks are made for one field, because each field has its own risks. Example: **bioethics** for healthcare; other frameworks for finance, education or transport.

2. Value-based frameworks rest on basic moral values. There are three kinds:

Type	Main idea	AI example
Rights-based	Protect human **rights and dignity**: privacy, freedom, equality, consent	A face-recognition system must not track people without consent
Utility-based	Choose the action that gives the **greatest good for the greatest number**; weigh benefits against harms	A traffic AI that cuts jams for most drivers
Virtue-based	Focus on the **character** of the decision-maker: honesty, fairness, compassion	A developer openly reports a flaw in her model

8 Bioethics: four principles

> **Bioethics:** the ethics of medicine and life sciences. It guides AI used in **healthcare**.

Principle	Meaning
Respect for autonomy	Patients decide about their own care after being told the facts (**informed consent**)
Do not harm	Avoid causing injury or suffering (non-maleficence)
Ensure maximum benefit for all	Act for the patient's good; do the most good possible (beneficence)
Give justice	Treat all patients **fairly and equally**; share benefits and risks fairly

9 Bioethics case study

A hospital system used an AI tool to pick patients who needed **extra care**. The tool used the **money spent on a patient in the past** as a sign of how ill the patient was. One community had always had less money spent on its care because of poor access, not because it was healthier. So the AI scored equally sick patients from that community as **less sick**, and fewer of them got extra care.

- **Problem:** biased data and a wrong indicator (cost ≠ illness).
- **Principles broken: justice** (unfair to one group) and **do not harm** (sick people missed care).
- **Lesson:** check training data for bias, choose indicators that truly measure need, test results for every group, keep humans in charge.

Key terms

16 terms

- **AI project cycle:** six stages to build an AI project
- **Stakeholders:** people affected by the problem
- **4Ws canvas:** Who, What, Where, Why – to scope a problem
- **SDGs:** 17 UN Sustainable Development Goals
- **Training data:** data used to teach the model
- **Testing data:** unseen data used to check the model
- **Data features:** the types of data needed for the project
- **Rule-based:** rules written by the developer
- **Learning-based:** machine learns rules from data
- **Deployment:** putting the model to real use
- **Ethical framework:** principles for morally right decisions
- **Bias:** unfair leaning for or against a group
- **Sector-based:** framework for one field, e.g. bioethics
- **Utility-based:** greatest good for the greatest number
- **Autonomy:** a patient's right to decide after knowing the facts
- **Justice:** fair and equal treatment of all

Common mistakes and exam tips

AVOID THESE

- The cycle has **six** stages in the current syllabus – do not forget **Deployment**.
- In the problem statement, **Who** = stakeholders, **Where** = context / situation, **Why** = benefit. Students often swap Where and Why.
- Bioethics is a **sector-based** framework, not a value-based one.
- Utility-based = **greatest good for the greatest number**; rights-based = protect each person's rights even if fewer people benefit.
- In a bioethics case, name the **principle** and then say **how** the case breaks or follows it – ½ mark each in the marking scheme.

PART A · 1 MARK EACH

A Objective Questions

15 questions: MCQs, assertion–reason, fill in the blanks and true/false, like Q2–Q5 of the board paper. Answers in Part E.

ASSERTION–REASON: HOW TO ANSWER

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

A1. Which stage of the AI project cycle comes immediately after Data Exploration? [1]

(a) Data Acquisition (b) Modelling (c) Evaluation (d) Problem Scoping

A2. In the 4Ws Problem Canvas, the block that identifies the people affected by the problem is: [1]

(a) Who (b) What (c) Where (d) Why

A3. A school builds an AI that predicts dropouts. It first asks, "In which classes and at what time of the year do students leave?" This question belongs to which W? [1]

(a) Who (b) What (c) Where (d) Why

A4. Which of these is NOT a good source of data for an AI project? [1]

(a) Government open-data portals (b) Sensors fitted on a farm
(c) Classmates' private chats copied without permission (d) A survey with consent

A5. An app reads the expression on a person's face from a photo. It belongs to which AI domain? [1]

(a) Data Science (b) Computer Vision (c) NLP (d) Robotics

A6. A city traffic system is planned to reduce waiting time for the largest number of commuters, even if a few roads get slower. Which framework guides this choice? [1]

(a) Rights-based (b) Virtue-based (c) Utility-based (d) Sector-based

A7. Bioethics is an example of a: [1]

(a) value-based framework (b) sector-based framework
(c) rule-based model (d) data feature

A8. A doctor explains the risks of a surgery and lets the patient decide whether to go ahead. Which bioethics principle is followed? [1]

(a) Respect for autonomy (b) Give justice
(c) Do not harm (d) Ensure maximum benefit

A9. Testing a trained model on data it has never seen, to check its accuracy, is done in the _____ stage. [1]

(a) Data Exploration (b) Modelling (c) Evaluation (d) Problem Scoping

A10. ASSERTION–REASON [1]

Assertion (A): An AI model trained on biased data can give unfair results.

Reason (R): An AI model learns the patterns present in its training data.

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

A11. ASSERTION–REASON [1]

Assertion (A): Virtue-based frameworks focus on the character and intentions of the decision-maker.

Reason (R): Rights-based frameworks aim at the greatest good for the greatest number.

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

A12. FILL IN THE BLANK [1]

Making the finished AI model available for real users, for example inside a mobile app, is called _____.

A13. FILL IN THE BLANK [1]

The bioethics principle that requires all patients to be treated fairly and equally is _____.

A14. TRUE OR FALSE [1]

In a rule-based approach, the machine discovers the rules by itself from data.

A15. TRUE OR FALSE [1]

Using a patient's past medical spending to judge how ill the patient is can make an AI system biased.

B — Short Answer Questions

PART B · 2 MARKS EACH

Answer in 20–30 words: two clear points. Model answers in Part E.

B1. Name the six stages of the AI project cycle in the correct order. MUST DO [2]

B2. What is the 4Ws Problem Canvas? Name its four blocks. [2]

B3. Differentiate between training data and testing data. [2]

B4. Why do AI systems need ethical frameworks? Give two reasons. MUST DO [2]

B5. Differentiate between sector-based and value-based ethical frameworks. [2]

B6. Write the problem statement template used in problem scoping. [2]

C — Long Answer Questions

PART C · 4 MARKS EACH

Answer in 50–80 words: four points, or two points with an example each. Model answers in Part E.

C1. Explain the three types of value-based ethical frameworks with one example of each from AI. MUST DO [4]

C2. State and explain the four principles of bioethics. MUST DO [4]

C3. Describe the Data Acquisition stage of the AI project cycle. [4]

C4. Identify the AI domain used in each case: (a) an app that converts a spoken Hindi sentence into English text; (b) a model that predicts tomorrow's electricity demand from past readings; (c) a camera that counts cars at a signal; (d) a chatbot on a bank website. [4]

C5. Explain Modelling, Evaluation and Deployment, and say why the AI project is called a cycle. [4]

D

PART D · CASE AND COMPETENCY BASED

Case-Based Questions

Read the situation, then answer from it and from the unit. These are the 4-mark board questions that test application.

D1. Case-Based · The hospital that missed the sick [4]

A hospital chain used an AI tool to decide which patients should join a special care programme. The tool gave each patient a score using how much money had been spent on that patient's treatment in earlier years. Later, doctors found that patients from a poorer community, who were just as ill, were getting lower scores, because less had been spent on them in the past.

(i) Which ethical framework should guide AI used in hospitals? [1]

(ii) Name two bioethics principles broken here and explain how. [2]

(iii) Suggest one way to correct the tool. [1]

D2. Competency-Based · Scoping a school project [4]

Students of Class X found that many people in their town throw dry and wet waste together, so the waste cannot be recycled. Sanitation workers spend extra hours separating it by hand. The students want to build an AI app that tells a person, from a photo, whether an item is dry or wet waste.

(i) Who are the stakeholders in this problem? [1]

(ii) Which AI domain will the app use? Why? [1]

(iii) Complete the problem statement for this project using the template. [2]

E

PART E · ANSWERS IN CBSE MARKING-SCHEME STYLE

Answers

Objective key with a reason, then model answers: numbered value points, key word first, the mark for each point in orange, and the word count under each answer. Any other correct, relevant point also earns the mark.

Objective questions – answer key

Part A

Write the option letter **and** the answer, as the marking scheme does.

Q	Answer	Why (one line)
A1	**(b) Modelling**	Scoping → Acquisition → Exploration → Modelling → Evaluation → Deployment.
A2	**(a) Who**	Who = stakeholders.
A3	**(c) Where**	Where = context or situation.
A4	**(c) Classmates' private chats copied without permission**	Data must be collected ethically, with consent.
A5	**(b) Computer Vision**	It works with images.
A6	**(c) Utility-based**	Greatest good for the greatest number.
A7	**(b) sector-based framework**	It is made for the healthcare sector.
A8	**(a) Respect for autonomy**	Informed consent = autonomy.
A9	**(c) Evaluation**	Evaluation uses testing data.
A10	**(a) Both true; R explains A**	The model copies the bias in its data – R explains A.
A11	**(c) A true, R false**	R describes utility-based frameworks, so R is false.
A12	**Deployment**	The last stage of the cycle.
A13	**Give justice (justice)**	Fair sharing of benefits and risks.
A14	**False**	Correct: in a rule-based approach the developer writes the rules; the machine learns rules only in the learning-based approach.
A15	**True**	Spending reflects access to care, not only illness.

Short answers

Part B · 2 marks

B1. Name the six stages of the AI project cycle in the correct order. [2]

1. **First three:** Problem Scoping, Data Acquisition, Data Exploration. 1
2. **Last three:** Modelling, Evaluation, Deployment. 1

13 words · CBSE asks 20–30 words | Marking: 1 + 1 = 2 | ½ for each pair in correct order (6 stages → 2 marks) | MUST DO

B2. What is the 4Ws Problem Canvas? Name its four blocks. [2]

1. **Meaning:** a tool used in problem scoping to understand a problem clearly. 1
2. **Blocks:** Who, What, Where and Why. 1

18 words · CBSE asks 20–30 words | Marking: 1 + 1 = 2 | 1 + 1

B3. Differentiate between training data and testing data. [2]

1. **Training data:** used to teach the model the patterns. 1
2. **Testing data:** new data, kept aside, used to check how well the model works. 1

23 words · CBSE asks 20–30 words | Marking: 1 + 1 = 2 | 1 + 1

B4. Why do AI systems need ethical frameworks? Give two reasons. [2]

1. **Bias:** AI learns from data that may be biased and can treat some groups unfairly. 1
2. **Wide impact:** AI decisions affect many people, so fairness, privacy and accountability must be checked first. 1

31 words · CBSE asks 20–30 words | Marking: 1 + 1 = 2 | Any two, 1 mark each | MUST DO

B5. Differentiate between sector-based and value-based ethical frameworks. [2]

1. **Sector-based:** made for one field, e.g. bioethics for healthcare. 1
2. **Value-based:** based on general moral values: rights, utility or virtue. 1

19 words · CBSE asks 20–30 words | Marking: 1 + 1 = 2 | 1 + 1

B6. Write the problem statement template used in problem scoping. [2]

1. **First line:** Our [stakeholders] has / have a problem that [issue] when / while [context]. 1
2. **Second line:** An ideal solution would [benefit for them]. 1

22 words · CBSE asks 20–30 words | Marking: 1 + 1 = 2 | 1 + 1

Long answers

Part C · 4 marks

C1. Explain the three types of value-based ethical frameworks with one example of each from AI. [4]

1. **Meaning:** value-based frameworks rest on basic moral values. 1
2. **Rights-based:** protects privacy, freedom and dignity, e.g. no face tracking without consent. 1
3. **Utility-based:** greatest good for the greatest number, e.g. traffic AI that helps most commuters. 1
4. **Virtue-based:** depends on good character, e.g. a developer honestly reports her model's flaw. 1

47 words · CBSE asks 50–80 words | Marking: 1 + 1 + 1 + 1 = 4 | 1 for meaning + 1 for each type with example | MUST DO

C2. State and explain the four principles of bioethics. [4]

1. **Respect for autonomy:** patients decide about their care after knowing the facts. 1
2. **Do not harm:** avoid injury or suffering to the patient. 1
3. **Maximum benefit:** act for the patient's good and do the most good possible. 1
4. **Justice:** treat all patients fairly and equally. 1

42 words · CBSE asks 50–80 words | Marking: 1 + 1 + 1 + 1 = 4 | ½ principle + ½ explanation, × 4 | MUST DO

C3. Describe the Data Acquisition stage of the AI project cycle. [4]

1. **Meaning:** collecting reliable and relevant data for the project. 1
2. **Features:** decide the data needed, e.g. rainfall and soil type for crop prediction. 1
3. **Sources:** surveys, sensors, cameras, web scraping, APIs and open government data. 1
4. **Ethics:** use permitted sources only; split data into training and testing sets. 1

45 words · CBSE asks 50–80 words | Marking: 1 + 1 + 1 + 1 = 4 | Any four points, 1 mark each

C4. Identify the AI domain used in each case: (a) an app that converts a spoken Hindi sentence into English text; (b) a model that predicts tomorrow's electricity demand from past readings; (c) a camera that counts cars at a signal; (d) a chatbot on a bank website. [4]

1. **(a):** NLP – it works with spoken and written language. 1
2. **(b):** Data Science – it uses numerical data. 1
3. **(c):** Computer Vision – it works with video images. 1
4. **(d):** NLP – it understands and replies to text. 1

32 words · CBSE asks 50–80 words | Marking: 1 + 1 + 1 + 1 = 4 | 1 mark each

C5. Explain Modelling, Evaluation and Deployment, and say why the AI project is called a cycle. [4]

1. **Modelling:** choosing a rule-based or learning-based model and training it. 1
2. **Evaluation:** testing the model on unseen data for accuracy, precision and recall. 1
3. **Deployment:** putting the model to real use in an app or machine and monitoring it. 1
4. **Cycle:** results send us back to improve data or model, so the stages repeat. 1

51 words · CBSE asks 50–80 words | Marking: 1 + 1 + 1 + 1 = 4 | 1 mark each

Case-based answers

Part D

D1. Case-Based · The hospital that missed the sick (passage printed in Part D) [4]

(i) Which ethical framework should guide AI used in hospitals? [1]

Bioethics, a sector-based framework for healthcare.

(ii) Name two bioethics principles broken here and explain how. [2]

(1) **Justice** – equally sick patients were treated unfairly because of their community. (2) **Do not harm** – sick patients were kept out of care they needed.

(iii) Suggest one way to correct the tool. [1]

Use a measure of **actual illness** (test results, number of conditions) instead of past spending, and check scores for every group before use.

Marking: 1 + 2 + 1 = 4 | 1 + (½ + ½) × 2 + 1; any other valid point

D2. Competency-Based · Scoping a school project (passage printed in Part D) **[4]**

(i) Who are the stakeholders in this problem? [1]

Households who throw the waste and **sanitation workers** who separate it.

(ii) Which AI domain will the app use? Why? [1]

Computer Vision, because it must identify the item from a photo.

(iii) Complete the problem statement for this project using the template. [2]

Our **households and sanitation workers** have a problem that **dry and wet waste are mixed** while **throwing waste at home**. An ideal solution would **tell people which bin to use, so waste can be recycled and workers save time**.

Marking: 1 + 1 + 2 = 4 | 1 + 1 + 2 (½ for each W)