

Class X

Artificial Intelligence

One-page chapter summaries
Large print • CBSE 2026-27 syllabus

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Based on the CBSE AI (417) Class X curriculum 2026-27 and the CBSE AI Facilitator Handbook Class X (Curriculum26 edition, which the marking scheme cites as 'CBSE Study material'). CBSE has not yet posted the 2026-27 skill-subject SQPs, so the questions come from the latest AI SQP and marking scheme (2025-26) and a few from 2024-25. Units 4 and 7 are assessed by practicals only, so their questions come from CBSE's suggested practical list. Theory paper: 50 marks (Part A 10, Part B 40); practical and project: 50.

Chapter 1: Revisiting AI Project Cycle & Ethical Frameworks for AI

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Big idea: Every AI project follows a 6-stage cycle, works in one of 3 data domains, and must be checked against an ethical framework so it causes no unintended harm.

Key points

- **AI Project Cycle (6 stages): Problem Scoping → Data Acquisition → Data Exploration → Modelling → Evaluation → Deployment.**
- **Problem scoping** sets the goal; **data acquisition** collects data from reliable, authentic sources; **data exploration** visualises it (graphs, flowcharts, maps) to see patterns.
- **Modelling** picks and tests models; **evaluation** tests on new data; **deployment** puts the solution into real-world use.
- Three AI domains by type of data: **Statistical Data** (price-comparison sites), **Computer Vision** (crop monitoring, surveillance), **NLP** (email filters, machine translation).
- **Framework** = set of steps giving step-by-step guidance to solve problems. **Ethical framework** = helps ensure our choices do not cause unintended harm.
- Why needed: AI is a decision-making tool, so it must make morally acceptable choices (e.g. a hiring algorithm biased against women).
- My Goodness activity: hidden factors that shape decisions, e.g. identity or **location** of recipient, bias towards relatives.
- Types: **Sector-based** (e.g. **Bioethics** in healthcare) and **Value-based**: rights-based, utility-based, virtue-based.

Key terms & facts

- **Rights-based**: protects human rights and dignity, values human life above all.
- **Utility-based**: maximise overall good for the greatest number.
- **Virtue-based**: character and intentions of decision-makers (honesty, compassion, integrity).
- **4 principles of Bioethics: Respect for Autonomy, Do not harm, Ensure maximum benefit for all, Give justice.**
- Training data must be unbiased, or AI repeats social biases (racism, sexism).

Exam focus: how to score

- Write stages in correct order; 2-mark answers need one line of explanation per stage.
- Case studies (4 marks): name 2 reasons for bias, then 2 bioethics principles and how each applies.
- Assertion-Reason MCQs often test the value-based frameworks.
- Match an example to its domain (CV / NLP / Statistical Data).

★ Important questions from CBSE sample papers

- With respect to the type of data fed into the AI model, AI models can be broadly classified into ____ domains. [Three] (SQP 2025-26, 1 mark)
- What do you do in the second and third stages of an AI Project Cycle? (SQP 2025-26, 2 marks)
- A school AI shortlists scholarship students by how fast they fill forms online. (a) Two reasons the results were biased. (b) Two bioethics principles that solve it. (SQP 2025-26, 4 marks)
- A self-driving car fails to detect pedestrians at night. Which AI domain should be improved? [Computer Vision] (SQP 2025-26, 1 mark)

Remember: Scope → Acquire → Explore → Model → Evaluate → Deploy; Bioethics = Autonomy, No harm, Max benefit, Justice.

Chapter 2: Advanced Concepts of Modeling in AI

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Big idea: AI is the umbrella, ML learns from data, DL learns from huge data with neural networks; models are rule-based or learning-based.

Key points

- **AI $\supset$ ML $\supset$ DL**. **ML**: machines improve with experience (object classification, anomaly detection). **DL**: trains itself on vast data (object identification, digit recognition).
- **Rule-based**: developer gives rules, so the model is static and cannot adapt to new data.
Learning-based: machine learns rules from data and adapts.
- **Supervised learning**: labelled data. Subtypes: **Classification** (discrete classes) and **Regression** (continuous values).
- **Unsupervised learning**: unlabelled data, finds hidden patterns. **Clustering** (group similar items, e.g. customer groups) and **Association** (bread $\rightarrow$ butter).
- **Reinforcement learning**: learns by trial and error from rewards. Useful when the environment is large, unforeseen or changing and data is scarce.
- **ANN**: modelled on the human brain, extracts features automatically; each node acts like a small ML algorithm.
- **CNN**: deep learning model that takes images and assigns importance (weights, biases) to features to tell objects apart.
- Neural network layers: **input layer** $\rightarrow$ **hidden layer(s)** (computation using weights and biases) $\rightarrow$ **output layer**; weights are adjusted using the error.

Key terms & formulas

- **Data** = information in any form. **Features** = columns (name, colour, size). **Label** = the feature we predict.
- **Labelled data** has a tag; **unlabelled data** is raw.
- **Training set**: examples the model learns from. **Testing set**: checks accuracy of the trained model.
- **Perceptron**: $y = w_1x_1 + w_2x_2 + \dots + w_nx_n + b$ (**bias**) (asked only as MCQ).

Exam focus: how to score

- Scenario $\rightarrow$ name the ML/DL application (anomaly detection, object classification, object identification, digit recognition).
- Know which learning type uses labelled vs unlabelled data; give one example each.
- Perceptron MCQ: multiply each input by its weight, add them, then add the bias.
- Features vs labels, training vs testing statements (true/false).

★ Important questions from CBSE sample papers

- A rule-based essay grader fails when students use new words. Most likely reason? [Rule-based approach is static, cannot adapt] (SQP 2025-26, 1 mark)
- Identify the deep learning model: (a) assigns weights and biases to image features (b) inspired by the human brain, each node a small ML algorithm. [CNN; ANN] (SQP 2025-26, 2 marks)
- How is reinforcement learning different from supervised and unsupervised learning? (SQP 2025-26, 2 marks)
- (a) Name the model that finds hidden patterns in unlabelled data. (b) Its two categories. (c) Explain each with an example. (SQP 2025-26, 4 marks)

Remember: Supervised = teacher with answers; Unsupervised = find groups yourself; Reinforcement = learn from rewards.

Chapter 3: Evaluating Models

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Big idea: Evaluation uses metrics on unseen test data to show how well a model works, so we can keep improving it until it is reliable.

Key points

- **Model evaluation:** using metrics to understand a model's performance, strengths and weaknesses. It is a feedback loop: build → feedback → improve.
- **Train-test split:** divide the dataset into a training set (to learn) and a testing set (to predict and compare). Used for supervised learning when the data is large enough.
- Do not evaluate on training data: the model memorises it → **overfitting** and an over-optimistic accuracy.
- **Error** = difference between the prediction and the actual value. Goal: minimise error, maximise accuracy.
- **Confusion matrix:** TP, TN, FP (predicted positive, actually negative), FN (predicted negative, actually positive).
- Accuracy misleads on unbalanced data (a model that always says 'Yes' on 900 Yes / 100 No still scores 90%).
- Use **Precision** when FPs are costly (satellite launch on a bad-weather day). Use **Recall** when FNs are costly (fraud, COVID detection).
- Ethical concerns in evaluation: **Bias, Transparency, Accuracy.**

Formulas

- $\text{Error} = |\text{Actual} - \text{Predicted}|$; $\text{Error rate} = \text{Error} \div \text{Actual}$; $\text{Accuracy} = 1 - \text{Error rate}$
- **$\text{Accuracy} = (\text{TP} + \text{TN}) \div (\text{TP} + \text{TN} + \text{FP} + \text{FN})$**
- **$\text{Precision} = \text{TP} \div (\text{TP} + \text{FP})$**
- **$\text{Recall} = \text{TP} \div (\text{TP} + \text{FN})$** (also called sensitivity or true positive rate)
- $\text{F1 Score} = 2 \times \text{Precision} \times \text{Recall} \div (\text{Precision} + \text{Recall})$
- $\text{Wrong predictions} = \text{FP} + \text{FN}$

Exam focus: how to score

- Draw the confusion matrix with Reality vs Prediction labelled (½ mark per cell).
- Always write the formula first: ½ mark for the formula, ½ for the answer.
- Choose the metric from the costlier mistake: FP costly → precision; FN costly → recall; unsure → F1.
- Error-rate MCQs: divide by the actual value, not the predicted value.

★ Important questions from CBSE sample papers

- 1000 emails, 300 spam; 240 spam caught, 60 legitimate marked spam. Precision? [0.80] (SQP 2025-26, 1 mark)
- House predicted ₹4,53,000, actual ₹4,88,000. Error rate (3 d.p.)? [0.071] (SQP 2025-26, 1 mark)
- What is model evaluation, and how does it help improve an AI model? (SQP 2025-26, 2 marks)
- Pass/fail model: TP 40, TN 30, FP 20, FN 10. (a) Confusion matrix (b) Accuracy (c) Wrong predictions. [70%; 30] (SQP 2025-26, 4 marks)

Remember: Precision watches false alarms; Recall watches misses.

Chapter 4: Statistical Data (practical unit)

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Big idea: Statistical Data is the data-science domain; no-code tools such as Orange let you run a full AI project by drag-and-drop.

Key points

- Assessed through **practicals** only (no theory marks in the 2026-27 scheme), but needed for the practical exam, project and viva.
- **Data science** unifies statistics, data analysis and ML. Uses: internet search, targeted advertising, website recommendations, genetics & genomics.
- Three ways to build: **High code** (write everything, e.g. Python; costly, fully customisable), **Low code** (visual tools plus some code), **No code** (drag-and-drop, no coding).
- **No-code AI**: build ML models in seconds without coding knowledge; cheap and simple but less customisable.
- No-code tools: **Orange Data Mining**, Lobe, Teachable Machine; MS Excel for statistical analysis.
- Use case: **Palmer Penguins** – predict penguin species with Orange, following the AI project cycle (explore → model → evaluate).
- Key statistics: **mean, median, mode** (central tendency), plus spread of the data; graphs for exploration.

Practical programs to know

- Mean, median and mode with NumPy: `np.mean()`, `np.median()`; mode with `statistics.mode()`
- Line chart (2,5) to (9,10): `plt.plot([2,9],[5,10]); plt.show()`
- Scatter chart: `plt.scatter(x, y)` for (2,5),(9,10),(8,3),(5,7),(6,18)
- Read a CSV: `df = pd.read_csv('file.csv');` `df.head(10); df.info()`

Exam focus: how to score

- Practical file: at least 15 programs (15 marks). Practical exam covers Units 4–7 (15 marks).
- Viva: be ready to explain no-code vs low-code vs high code with one tool each.
- Project option 1: Statistical Data – prediction of Palmer penguin species.

★ Important questions from CBSE sample papers

- Write a program to calculate mean, median and mode using NumPy. (CBSE curriculum 2026-27, suggested practical)
- Read a CSV file saved in your system and display 10 rows. (CBSE curriculum 2026-27, suggested practical)
- Write a program to display a scatter chart for the points (2,5), (9,10), (8,3), (5,7), (6,18). (CBSE curriculum 2026-27, suggested practical)

Remember: High code = write it all; Low code = some code; No code = drag & drop (Orange).

Chapter 5: Computer Vision

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Big idea: Computer Vision lets machines get information from pixels: images are grids of numbers that CNNs turn into decisions.

Key points

- **CV:** machine acquires, screens and analyses visual information, then predicts or decides. **Image processing** (resizing, brightness, tone) is a subset of CV.
- Applications: facial recognition (attendance, security), **face filters** (Instagram, Snapchat), Google search by image, CV in retail (inventory), self-driving cars, medical imaging, Google Translate camera.
- CV tasks: **Classification** (one label per image), **Classification + Localisation** (what and where, single object), **Object Detection** (finds instances of objects; image retrieval, auto parking), **Instance Segmentation** (labels every pixel).
- **Pixel** = picture element, the smallest unit of an image. **Resolution** = number of pixels, e.g. $1280 \times 1024 = 1,310,720 \approx 1.31$ megapixels.
- **Byte image:** each pixel stored in 8 bits → values 0–255 (0 = black/no colour, 255 = white/full colour).
- **Grayscale:** one plane, 1 byte per pixel, size = height × width. **RGB:** three planes (R, G, B), each pixel has 3 values.
- **Convolution:** slide a **kernel** (matrix) over the image, multiply and add → feature map (edges, blur, sharpen).
- **CNN layers: Convolution → ReLU → Pooling → Fully Connected**

CNN layer by layer

- **Convolution layer:** extracts features such as edges; output is the **feature map**.
- **ReLU:** turns negative values into 0 and adds non-linearity.
- **Pooling:** shrinks the feature map and keeps key features. **Max pooling** keeps the largest value, **average pooling** the mean.
- **Fully connected layer:** flattens the features and classifies the image (gives a probability for each label).

Exam focus: how to score

- Picture-based MCQs: identify the CV application or task from a photo.
- Byte-image answer (2 marks): 8 bits = 1 byte → 256 values (0–255); link it to binary.
- Know the order of CNN layers and one job for each.
- No-code CV in practicals: Lobe, Teachable Machine (smart sorter), Orange coral-bleaching case.

★ Important questions from CBSE sample papers

- ____ enhances raw images (rescaling, brightness, tone); it is a subset of _____. [Image Processing; Computer Vision] (SQP 2025-26, 1 mark)
- 1280×1024 , 1920×1080 , 640×480 describe an image's _____. [Resolution] (SQP 2025-26, 1 mark)
- Identifying and locating real-world objects (faces, bicycles) in images or videos, used in automated parking, is _____. [Object Detection] (SQP 2025-26, 1 mark)
- What is a 'byte image' format in the context of digital images? (SQP 2025-26, 2 marks)
- Explain the term resolution with an example. (SQP 2024-25, 2 marks)

Remember: 0 = black, 255 = white; Conv → ReLU → Pool → FC.

Chapter 6: Natural Language Processing

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Big idea: NLP lets computers read and understand human language by cleaning text, then turning words into numbers (Bag of Words, TF-IDF).

Key points

- Natural language is hard for machines: the same word has **different meanings in context**, and sentences can be correct in grammar yet make no sense.
- Applications: voice assistants, **auto-generated captions**, language translation, sentiment analysis, text classification, keyword extraction.
- **Stages: Lexical analysis → Syntactic analysis (parsing) → Semantic analysis → Discourse integration → Pragmatic analysis.**
- **Syntactic:** checks grammar and word arrangement ('We are to the zoo going' fails). **Semantic:** checks meaning. **Pragmatic:** checks real-world relevance.
- **Chatbots: script bot** (pre-written rules, easy, free, limited) vs **smart bot** (AI-based, flexible, learns, needs data). Examples: Elizabot, Mitsuku, Cleverbot.
- **Text normalisation:** sentence segmentation → **tokenisation** → remove stop words, special characters and numbers → common (lower) case → stemming / lemmatisation.
- **Stemming** cuts affixes (word may lose meaning: flies → fli); **lemmatisation gives a meaningful word (flies → fly).**
- **Bag of Words:** normalise → make a dictionary of unique words → a document vector for each document (counts). Word order does not matter.

Formulas & definitions

- **Corpus** = all the text documents together. **Token** = each word, number or punctuation mark.
- **Stop words** (a, an, the, and, is) occur often but add little meaning.
- TF = frequency of a word in one document; DF = number of documents that contain it
- **$TFIDF(W) = TF(W) \times \log(IDF(W))$, where $IDF(W) = \text{total documents} \div DF(W)$**
- High TF-IDF = frequent in this document but rare in the corpus → a valuable word. Uses: document classification, topic modelling, information retrieval, stop-word filtering.

Exam focus: how to score

- BoW 4-mark question: list the vocabulary, write the vector row, explain feature extraction, and say why order is ignored.
- Identify the NLP stage from a pair of sentences (syntactic vs semantic).
- Token counting: punctuation marks count as tokens.
- Script bot vs smart bot: 2–3 differences in a table.

★ Important questions from CBSE sample papers

- Which bot works on pre-written instructions, is mostly free and has limited functionality? [Script bot] (SQP 2025-26, 1 mark)
- Stemmed and lemmatised forms of 'flies'? [fli; fly] (SQP 2025-26, 1 mark)
- Identify the NLP stage: 'We are to the zoo going tomorrow' vs 'We are going to the zoo tomorrow.' [Syntactic analysis] (SQP 2025-26, 2 marks)
- Three documents on AI: (a) make the dictionary (b) document vector for Doc 3 (c) how BoW helps feature extraction (d) why word order is ignored. (SQP 2025-26, 4 marks)
- Can we face challenges teaching computers human languages? Explain. (SQP 2024-25, 4 marks)

Remember: Lexical → Syntax → Semantic → Discourse → Pragmatic; stem chops, lemma keeps meaning.

Chapter 7: Advance Python (practical unit)

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Big idea: Python is the tool for AI practicals: Jupyter Notebook, core syntax, and libraries such as NumPy, Pandas, Matplotlib and OpenCV.

Key points

- Assessed through **practicals** only; together with Units 4–6 it makes up the 15-mark practical exam and the 5-mark viva.
- **Jupyter Notebook**: web-based tool for running Python in cells; part of the **Anaconda** distribution.
- **Virtual environment**: a separate workspace with its own packages; install packages with **pip install** (or conda).
- Basics recap: variables, data types (int, float, str, list, tuple, dict), operators, input() / print().
- Control structures: **if-elif-else**, **for** and **while** loops; lists and list operations.
- Libraries: **NumPy** (arrays, statistics), **Pandas** (CSV and DataFrames), **Matplotlib** (charts), **OpenCV** (images).

Practical programs (CBSE list)

- Add two lists element-wise: `[a+b for a,b in zip(L1, L2)]`
- Line chart from (2,5) to (9,10): `plt.plot([2,9],[5,10])`
- Read CSV and show info: `df=pd.read_csv('data.csv');` `df.info()`
- Read and show an image: `img=cv2.imread('a.jpg');` `plt.imshow(img)`
- Image shape: `print(img.shape)` → (height, width, channels)

Exam focus: how to score

- The practical file must have at least 15 programs (15 marks); keep the output with each program.
- Viva: what NumPy, Pandas and Matplotlib are for; what `img.shape` returns.
- Project or portfolio (10 marks + 5 viva): link it to an SDG, e.g. sentiment analysis or coral bleaching.

★ Important questions from CBSE sample papers

- Write a program to add the elements of two lists. (CBSE curriculum 2026-27, suggested practical)
- Write a program to display a line chart from (2,5) to (9,10). (CBSE curriculum 2026-27, suggested practical)
- Write a program to read an image and identify its shape using Python. (CBSE curriculum 2026-27, suggested practical)

Remember: NumPy = numbers, Pandas = tables, Matplotlib = charts, OpenCV = images.

Chapter A: Part A: Employability Skills (Units 1-5)

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Big idea: 10 easy marks: Section A has 6 MCQs (answer any 4) and Section B has 5 short answers (answer any 3).

Key points

- **Communication Skills-II:** verbal, non-verbal and visual communication. Non-verbal includes facial expression, posture, **gesture** (raising a hand, pointing) and eye contact.
- Parts of speech: a **pronoun** replaces a noun (Kavita bought a book. **She**...). Best practices: be clear and concise, listen actively.
- **Self-Management Skills-II:** responsibility, self-awareness, time management, adaptability. To manage emotions, observe your behaviour, meditate, think rationally; don't decide on emotion alone.
- **Self-motivation steps: find your strengths → set and focus on goals → make a plan → stay loyal to your goals.**
- **ICT Skills-II:** file management (hover = show details without clicking). Data leaks when we share details on unsafe sites or leave a computer logged in. A Trojan horse is malware disguised as useful software.
- **Entrepreneurial Skills-II:** an entrepreneur makes decisions, manages the business, takes risks. Career stages: Enter → Survive → **Grow** (e.g. opening new branches).
- **Green Skills-II:** sustainable development and the 17 SDGs. Donating unused items → **SDG 12** (responsible consumption).
- **Organic farming** uses no chemical pesticides or fertilisers, giving chemical-free crops and keeping the soil fertile.

Exam focus: how to score

- 2-mark answers: 20-30 words, two clear points (1 mark each), or a definition plus an example.
- Case-based MCQs: read the behaviour, then match the skill (e.g. responsibility).
- Revise the NCERT Employability Skills Class X book; the marking scheme cites its pages.

★ Important questions from CBSE sample papers

- Raising a hand to greet or pointing a finger is which non-verbal communication? [Gesture] (SQP 2025-26, 1 mark)
- What is a pronoun? Give an example. (SQP 2025-26, 2 marks)
- List four steps to build self-motivation. (SQP 2025-26, 2 marks)
- Reema decides what soaps to make and assigns tasks to staff. Name two functions of an entrepreneur shown. [Making decisions; managing the business] (SQP 2025-26, 2 marks)
- What is organic farming? Mention any two benefits. (SQP 2025-26, 2 marks)

Remember: Strengths → Goals → Plan → Stay loyal.