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

PART B · UNIT 5

Computer Vision

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

Part B · 4 of 40 theory marks | 26 questions with model answers | Sonakshi Ma'am | Taught: Fri 27 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

What computer vision is and where it is used, the four computer vision tasks, pixels, resolution and pixel values, grayscale and RGB images, and – for the lab – image features, convolution and the layers of a CNN.

THIS UNIT IN THE BOARD PAPER

4 / 40

Unit 5 carries **4 theory marks** (the no-code tools, convolution and CNN part is tested in the practical exam). In the CBSE sample paper it gave **4 one-mark items** (some picture-based) and a **2-mark** question on byte images.

SYLLABUS 2026–27 · WHAT CBSE LISTS FOR THIS UNIT

- Computer vision: meaning and applications
- Computer vision tasks: classification, localisation, object detection, instance segmentation
- Pixels, resolution and pixel values
- Grayscale and RGB images
- Practical part: no-code tools (Teachable Machine, Lobe, Orange), convolution, CNN

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.

PRACTICAL WORK FOR THIS UNIT

Emoji scavenger hunt · RGB colour calculator · pixel art on a grid · convolution kernel demo · build a ‘smart sorter’ image classifier in a no-code tool · coral bleaching classification walkthrough.

1 What is computer vision?

> **Computer vision (CV):** the domain of AI that lets computers **see, understand and make decisions** from images and videos.

A camera gives the computer only numbers (pixel values). CV finds **patterns** in these numbers to recognise faces, objects, text or movement.

2 Applications of computer vision

Field	Example
Phones	Face unlock, face filters, photo search by object
Search	Searching the web with a photo (e.g. Google Lens)
Transport	Self-driving cars spotting lanes, signals, people
Health	Finding disease in X-rays and scans
Shops	Self-checkout; counting stock on shelves
Farming	Spotting crop disease from leaf photos
Security and traffic	Number-plate reading; crowd monitoring

3 Computer vision tasks

Task	What it does	Objects
Classification	Gives the whole image **one label** ('cat')	Single object
Classification + localisation	Labels the object **and** draws a box around it	Single object
Object detection	Finds **every** object of known classes and boxes each one	Many objects
Instance segmentation	Marks the **exact pixels** of each object, separately	Many objects

SAME IMAGE, FOUR TASKS
A street photo: classification says 'street'; detection boxes 3 cars and 2 people; instance segmentation colours each car and person pixel by pixel.

4 Pixels and resolution

- **Pixel** (picture element): the **smallest unit** of a digital image; the image is a grid of pixels.
- **Resolution:** the number of pixels, written **width × height**. More pixels = more detail.
- 1280 × 720 = 9,21,600 pixels. 1920 × 1080 = 20,73,600 pixels ≈ 2.07 megapixels (1 MP ≈ 10 lakh pixels).

5 Pixel values

- Each pixel stores a number for its brightness or colour.
- In a **byte image** each pixel value is stored in **1 byte = 8 bits**, so it ranges from **0 to 255** (2^8 = 256 values).
- **0 = black** (no light), **255 = white** (full light); values in between are shades.

6 Grayscale and RGB images

	Grayscale image	RGB (colour) image
Channels	**One**	**Three**: Red, Green, Blue
Each pixel	One value 0–255 (black to white)	Three values, each 0–255
Bytes per pixel	1	3
Colours	256 shades of grey	256 × 256 × 256 = 1,67,77,216 (about 1.68 crore) colours

RGB value	Colour
(255, 0, 0)	Red
(0, 255, 0)	Green
(0, 0, 255)	Blue
(255, 255, 0)	Yellow
(0, 0, 0)	Black
(255, 255, 255)	White

7 For the lab: features, convolution and CNN

- **Image features:** useful patterns such as **edges**, **corners** and blobs that help identify an object.
- **Convolution:** a small grid of numbers called a **kernel (filter)** slides over the image; at each place the pixel values are multiplied by the kernel values and added to give one new pixel. Different kernels blur, sharpen or find edges.
- **CNN (convolutional neural network)** layers: **convolution layer** (finds features) → **ReLU** (keeps positive values) → **pooling layer** (shrinks the image, keeps important features) → **fully connected layer** (gives the final label).

This part is tested in the practical exam and viva, not in the theory paper.

Key terms

15 terms

Computer vision: AI domain that understands images and videos

Pixel: smallest unit of a digital image

Resolution: number of pixels, width × height

Megapixel: about 10 lakh pixels

Byte image: each pixel stored in 8 bits, 0–255

Grayscale: one channel, shades from black to white

RGB: three channels: red, green, blue

Classification: one label for the image

Localisation: box around one object

Object detection: boxes around many objects

Instance segmentation: exact pixels of each object

Kernel: small grid used in convolution

Convolution: kernel slides, multiplies and adds

Pooling: shrinks image, keeps key features

CNN: network that learns image features

Common mistakes and exam tips

AVOID THESE

- Pixel values run from **0 to 255** – 0 is black, 255 is white.
- Grayscale has **1** channel; RGB has **3**.
- Classification and localisation are for **one** object; detection and segmentation handle **many**.
- Resolution = **width × height**; multiply carefully.
- Byte image: 1 byte = 8 bits → $2^8 = 256$ values.

A

PART A · 1 MARK EACH

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. Face unlock on a smartphone is an application of: [1]

(a) Natural Language Processing **(b)** Computer Vision
(c) Statistical Data **(d)** Rule-based chatbots

A2. The smallest unit of a digital image is a: [1]

(a) Byte **(b)** Pixel
(c) Kernel **(d)** Channel

A3. In a byte image, pixel values range from: [1]

(a) 0 to 100 **(b)** 1 to 256
(c) 0 to 255 **(d)** 0 to 1

A4. A pixel value of 0 in a grayscale image appears: [1]

(a) White **(b)** Black
(c) Grey **(d)** Red

A5. How many channels does an RGB image have? [1]

(a) 1 **(b)** 2 **(c)** 3 **(d)** 4

A6. An image is 800 × 600 pixels. Its total number of pixels is: [1]

(a) 1,400 **(b)** 4,80,000
(c) 48,000 **(d)** 4,800

A7. A model draws boxes around every car and person in a street photo. This task is: [1]

(a) Classification **(b)** Object detection
(c) Classification + localisation **(d)** Grayscale conversion

A8. The RGB value (255, 255, 255) gives: [1]

(a) Black **(b)** White
(c) Red **(d)** Yellow

A9. Which task marks the exact pixels of each separate object? [1]

(a) Classification **(b)** Localisation
(c) Instance segmentation **(d)** Pooling

A10. ASSERTION–REASON [1]

Assertion (A): A grayscale image needs less storage than an RGB image of the same size.

Reason (R): Each grayscale pixel has one value; each RGB pixel has three.

(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): Higher resolution means fewer pixels in an image.

Reason (R): Resolution is written as width × height.

(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]

In convolution, the small grid of numbers that slides over the image is called a _____ .

A13. FILL IN THE BLANK [1]

The RGB value (255, 0, 0) shows the colour _____.

A14. TRUE OR FALSE [1]

Classification + localisation is used when an image has many objects.

A15. TRUE OR FALSE [1]

A self-driving car uses computer vision to spot lanes and traffic signals.

B — Short Answer Questions

PART B · 2 MARKS EACH

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

B1. What is a byte image? MUST DO [2]

B2. Define computer vision. Give one application. [2]

B3. Differentiate between a grayscale image and an RGB image. MUST DO [2]

B4. What is resolution? Find the pixels in a 1024 × 768 image. [2]

B5. Differentiate between classification and object detection. [2]

B6. How many bytes are needed to store a 10 × 10 image in (a) grayscale (b) RGB? [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 four tasks of computer vision with an example. MUST DO [4]

C2. Explain any four applications of computer vision. [4]

C3. Explain pixels, resolution, pixel value and RGB. MUST DO [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 fruit-sorting machine [4]

A juice factory installs a camera above a conveyor belt. The system must find every apple and orange on the belt, draw a box around each one and push rotten fruit aside. The camera takes colour photos of 640 × 480 pixels.

(i) Which AI domain is used here? [1]

(ii) Which computer vision task finds and boxes every fruit? [1]

(iii) How many pixels are in each photo? How many values does each pixel store, and why? [2]

D2. Competency-Based · Reading a tiny image [4]

A student zooms into a grayscale photo until she sees a 3 × 3 block of pixels with these values:

0 128 255
0 128 255
0 128 255

(i) What colour are the left and right columns? [1]

(ii) What will the middle column look like? Why? [1]

(iii) How many bytes does this block need in grayscale, and how many if it were RGB? [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) Computer Vision**	Works on camera images.
A2	**(b) Pixel**	Picture element.
A3	**(c) 0 to 255**	8 bits = 256 values.
A4	**(b) Black**	No light.
A5	**(c) 3**	Red, green, blue.
A6	**(b) 4,80,000**	800 × 600 = 4,80,000.
A7	**(b) Object detection**	Many objects, each boxed.
A8	**(b) White**	All channels full.
A9	**(c) Instance segmentation**	Pixel-level outline per object.
A10	**(a) Both true; R explains A**	R explains A.
A11	**(d) A false, R true**	A false (more pixels); R true.
A12	**kernel (filter)**	Used to find features.
A13	**red**	Only the red channel is full.
A14	**False**	Correct: it is for a single object; object detection handles many.
A15	**True**	Real-time image understanding.

Short answers

Part B · 2 marks

B1. What is a byte image? [2]

1. **Meaning:** an image where each pixel value is stored in one byte (8 bits). 1
2. **Range:** so values run from 0 (black) to 255 (white). 1

24 words · CBSE asks 20–30 words | Marking: 1 + 1 = 2 | 1 + 1 | MUST DO

B2. Define computer vision. Give one application. [2]

1. **Meaning:** AI domain that lets computers see and understand images and videos. 1
2. **Application:** face unlock, or disease detection in X-rays. 1

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

B3. Differentiate between a grayscale image and an RGB image. [2]

1. **Grayscale:** one channel; each pixel one value 0–255. 1
2. **RGB:** three channels; each pixel three values 0–255. 1

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

B4. What is resolution? Find the pixels in a 1024 × 768 image. [2]

1. **Resolution:** number of pixels, width × height. 1
2. **Pixels:** 1024 × 768 = 7,86,432. 1

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

B5. Differentiate between classification and object detection. [2]

1. **Classification:** one label for the whole image, one object. 1
2. **Object detection:** finds and boxes every object of known classes. 1

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

B6. How many bytes are needed to store a 10 × 10 image in (a) grayscale (b) RGB? [2]

1. **Grayscale:** 100 pixels × 1 byte = 100 bytes. 1
2. **RGB:** 100 pixels × 3 bytes = 300 bytes. 1

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

Long answers

Part C · 4 marks

C1. Explain the four tasks of computer vision with an example. [4]

1. **Classification:** one label – ‘dog’. 1
2. **Classification + localisation:** label plus a box around the dog. 1
3. **Object detection:** boxes around all dogs and cats. 1
4. **Instance segmentation:** exact pixels of each animal. 1

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

C2. Explain any four applications of computer vision. [4]

1. **Phones:** face unlock and filters. 1
2. **Health:** finding disease in scans. 1
3. **Transport:** self-driving cars read lanes and signals. 1
4. **Farming:** detecting crop disease from leaf photos. 1

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

C3. Explain pixels, resolution, pixel value and RGB. **[4]**

1. **Pixel:** smallest unit of an image. 1
2. **Resolution:** width × height in pixels. 1
3. **Pixel value:** 0 (black) to 255 (white). 1
4. **RGB:** three channels; (255, 0, 0) is red. 1

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

Case-based answers

Part D

D1. Case-Based · The fruit-sorting machine (passage printed in Part D) **[4]**

(i) Which AI domain is used here? [1]

Computer vision.

(ii) Which computer vision task finds and boxes every fruit? [1]

Object detection (many objects, each boxed).

(iii) How many pixels are in each photo? How many values does each pixel store, and why? [2]

640 × 480 = **3,07,200 pixels**. Each pixel stores **3 values** because it is an **RGB** colour image (red, green, blue).

Marking: 1 + 1 + 2 = 4 | 1 + 1 + (1 + 1)

D2. Competency-Based · Reading a tiny image (passage printed in Part D) **[4]**

(i) What colour are the left and right columns? [1]

Left column (0) is **black**; right column (255) is **white**.

(ii) What will the middle column look like? Why? [1]

Grey – 128 is about halfway between 0 and 255.

(iii) How many bytes does this block need in grayscale, and how many if it were RGB? [2]

9 pixels × 1 byte = **9 bytes** in grayscale; 9 × 3 = **27 bytes** in RGB.

Marking: 1 + 1 + 2 = 4 | 1 + 1 + 2