आर्टिफिशियल इंटेलिजेंस
Artificial Intelligence

कक्षा / Class X
2026-27

विद्यार्थी सहायक सामग्री
Student Support Material

केन्द्रीय विद्यालय संगठन~Kendriya Vidyalaya Sangathan

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संदेश

शिक्षा केवल पुस्तकों तक सीमित ज्ञान नहीं है; यह स्वयं को पहचानने, अपने विचारों को विस्तार देने और जीवन की चुनौतियों का आत्मविश्वास से सामना करने की सतत् यात्रा है। केन्द्रीय विद्यालय संगठन का सदैव यह प्रयास रहा है कि प्रत्येक विद्यार्थी के लिए ऐसा शिक्षण वातावरण हो, जहाँ जिज्ञासा को प्रोत्साहन मिले, सीखना आनंददायी बने और प्रत्येक बालक अपनी अंतर्निहित क्षमताओं को पहचानकर उन्हें विकसित कर सके।

राष्ट्रीय शिक्षा नीति 2020 ने शिक्षा को सिर्फ रटने से समझने, सूचना से ज्ञान और ज्ञान से जीवनोपयोगी दक्षताओं की ओर अग्रसर किया है। आज का समय कृत्रिम बुद्धिमत्ता (Artificial Intelligence – AI), डिजिटल नवाचार और निरंतर बदलती तकनीकों का है। ऐसे युग में केवल तथ्यों का ज्ञान पर्याप्त नहीं है; आवश्यक है कि विद्यार्थी मनन- चिंतन करना सीखें, प्रश्न पूछें, समस्याओं का समाधान खोजें और नए विचारों के साथ आगे बढ़ें। यही क्षमताएँ उन्हें भविष्य के लिए तैयार करेंगी।

इन्हीं उद्देश्यों को ध्यान में रखते हुए केन्द्रीय विद्यालय संगठन के पाँचों आंचलिक शिक्षा एवं प्रशिक्षण संस्थानों (ZIETs) के माध्यम से, समर्पित एवं अनुभवी शिक्षकों द्वारा कक्षा 9 से 12 के विद्यार्थियों के लिए यह विद्यार्थी सहायक सामग्री तैयार की गई है। यह केवल परीक्षा की तैयारी की संकलन सामग्री नहीं है, बल्कि विषयों को सरलता से समझने, अवधारणाओं को स्पष्ट करने, नियमित अभ्यास करने और आत्मविश्वास के साथ आगे बढ़ने का एक विश्वसनीय साथी है।

इस सामग्री में विषय-वस्तु को विद्यार्थियों की आवश्यकताओं के अनुरूप सरल, व्यवस्थित एवं दक्षता-आधारित दृष्टिकोण से प्रस्तुत किया गया है। मुझे प्रसन्नता है कि इसे हमारे शिक्षकों के अनुभव, नवाचार और विद्यार्थियों के प्रति उनकी प्रतिबद्धता ने समृद्ध बनाया है। मुझे विश्वास है कि यह सामग्री विद्यार्थियों की सीखने की यात्रा को अधिक सहज, रोचक और प्रभावी बनाएगी तथा उन्हें बोर्ड परीक्षाओं के साथ-साथ जीवन की व्यापक चुनौतियों के लिए भी तैयार करेगी।

मेरा विश्वास है कि जब एक जिज्ञासु विद्यार्थी, प्रेरित शिक्षक और सार्थक शिक्षण संसाधन एक साथ आते हैं, तब शिक्षा केवल उपलब्धि का माध्यम नहीं रहती, बल्कि व्यक्तित्व निर्माण की एक सशक्त प्रक्रिया बन जाती है। यही भावना इस विद्यार्थी सहायक सामग्री के केंद्र में है।

मेरी हार्दिक शुभकामनाएँ हैं कि आप सभी सीखने की इस यात्रा में निरंतर आगे बढ़ें, अपने सपनों को नए आयाम दें और ज्ञान, संवेदनशीलता तथा नवाचार के साथ राष्ट्र निर्माण में अपना महत्वपूर्ण योगदान दें।

शुभकामनाओं सहित।

(विकास गुप्ता)

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About student support material

The Student Support Material (SSM) for Class X Artificial Intelligence (417) has been prepared for the academic session 2026–27 under the guidance of Kendriya Vidyalaya Sangathan (KVS), Headquarters, New Delhi. As per the directions issued by KVS HQ, the responsibility for preparing the SSM for Artificial Intelligence was assigned to the KVS Zonal Institute of Education and Training (ZIET), Mysuru.

To ensure quality, relevance, and student-friendly presentation, ZIET Mysuru collaborated with experienced PGTs (Computer Science) from different Kendriya Vidyalaya regions including Bhubaneswar, Ernakulam, and Agra. The combined efforts of these educators helped in developing comprehensive, well-structured, and examination-oriented learning material for students.

The Student Support Material has been designed in accordance with the latest CBSE guidelines, National Education Policy (NEP) 2020, Competency-Based Education (CBE) principles, and NCERT learning outcomes.

This material aims to support students in understanding concepts in a simple and systematic manner, developing analytical and problem-solving skills, practicing competency-based and application-oriented questions, and preparing effectively for school and board examinations.

The content has been organized carefully to make learning easier and more engaging. Each chapter generally includes:

- Infographics
- Main Points and Concept Notes
- Multiple Choice Questions (MCQs)
- Short Answer Questions
- Case Study and Application-Based Questions
- Practice and Revision Content

Special Features of the SSM

- ✓ Simple and student-friendly language
- ✓ Real-life applications of concepts
- ✓ Logical and systematic flow of topics
- ✓ Skill-based and competency-focused assessment
- ✓ Structured and readable presentation

This Student Support Material is not only a guide but also a learning companion that encourages conceptual understanding, critical thinking, creativity, and practical application of knowledge.

Students are encouraged to use this material regularly for classroom learning, homework, revision, self-assessment, and exam preparation. Consistent use of the SSM will help learners become more confident, independent, and successful in Artificial Intelligence (417).

We sincerely hope that this collaborative effort by KVS ZIET Mysuru and participating teachers from various regions will benefit students and contribute positively to their academic growth and future readiness.

How to Use this Student Support Material (SSM)

Welcome to the Student Support Material for Class X Artificial Intelligence (417). This resource has been systematically structured to simplify complex concepts, making it easier for you to learn, revise, and approach your examinations with confidence.

Best Practices for Effective Learning

To get the most out of this material, we recommend following this step-by-step study plan:

- **Understand the Foundations**: Begin by thoroughly reading the core notes to build a strong conceptual base.
- **Master Key Vocabulary**: Focus on learning essential AI terminology and real-world examples.
- **Build Speed with MCQs:** Solve the Multiple-Choice Questions to test your quick-recall and factual knowledge.
- **Develop Writing Skills**: Practice short and long-answer questions to improve your ability to articulate complex ideas.
- **Analyze Case Studies**: Tackle case-study based questions to understand how AI is applied in practical/real world scenarios.
- **Visual Revision**: Use the Infographic Sheets for quick visual summaries and review your weekly progress to ensure long-term retention.
- **Collaborate and Clarify**: Don't hesitate to discuss challenging topics with your teachers or peers.

Versatile Usage

This SSM is your go-to companion for:

- Daily Self-Study & Homework
- Classroom Tests & Unit Exams
- Pre-Board & Board Exam Preparation

By using this material consistently, you will develop a sharper understanding of Artificial Intelligence, boost your academic confidence, and significantly enhance your exam performance.

Happy Learning and Best Wishes for your Success!

CBSE CURRICULUM 2026-27

ARTIFICIAL INTELLIGENCE (SUBJECT CODE 417) CLASS – X

(SESSION 2026-2027)

Total Marks: 100 (Theory-50 + Practical-50)

PART – A EMPLOYABILITY SKILLS

UNITS	NO. OF HOURS for Theory and Practical	MAX. MARKS for Theory and Practical
Unit 1: Communication Skills-II	10	2
Unit 2: Self-Management Skills-II	10	2
Unit 3: ICT Skills-II	10	2
Unit 4: Entrepreneurial Skills-II	10	2
Unit 5: Green Skills-II	10	2
Total	**50**	**10**

PART – B SUBJECT SPECIFIC SKILLS

UNITS	Theory (hours)	Practical (hours)	Marks
Unit 1: Revisiting AI Project Cycle & Ethical Frameworks for AI	11	4	7
Unit 2: Advanced Concepts of Modeling in AI	18	7	11
Unit 3: Evaluating Models	21	4	10
Unit 4: Statistical Data	–	28	–
Unit 5: Computer Vision	10	20	4
Unit 6: Natural Language Processing	20	7	8
Unit 7: Advance Python		10	–
Total	**160**		**40**

PART – C

Practical & Project Work:		Marks
Practical File with minimum 15 Programs		15
Practical Examination ● Unit 4: Statistical Data ● Unit 5: Computer Vision ● Unit 6: Natural Language Processing ● Unit 7: Advance Python		15
Viva Voce		5
Project Work / Field Visit / Student Portfolio (Anyone to be done)		10
Viva Voce (related to project work)		5
Total		**50**
GRAND TOTAL	**210**	**100**

Web Links : CBSE SYLLABUS 2026-27 PART-A PART-B

PART – A: EMPLOYABILITY SKILLS

UNIT- 1: COMMUNICATION SKILLS-II

1. Introduction to Communication

The word ‘communication’ comes from the Latin word communicare, which means ‘to share’.

The Communication Cycle:

- Transmitting: The sender transmits the message through one medium or another.
- Listening: The receiver listens or understands the message.
- Feedback: The receiver responds to the sender, completing the cycle.

Elements of Communication:

- Sender: The person starting the communication.
- Message: The information being shared.
- Channel: The means used to send information (phone, face-to-face, writing).
- Receiver: The person who gets the message.
- Feedback: The response that shows the message was understood.

2. Methods of Communication

a. Verbal Communication: It is the sharing of information using sounds, words, and language.

- Interpersonal: One-on-one (e.g., two friends talking).
- Written: Letters, emails, SMS, reports.
- Small Group: More than two people (e.g., board meetings, team huddles).
- Public: One person addressing a large crowd (e.g., a speech).

b. Non-Verbal Communication: It is the expression or exchange of information or messages without using any spoken or written word

Importance: 93% of communication is non-verbal (55% body movements/face, 38% voice tone/pauses, and only 7% words).

Types: Facial expressions, posture, gestures, touch, space, eye contact, and paralanguage (tone, speed, and volume).

c. Visual Communication: Using images or pictures (e.g., traffic signs, "No Parking" signs, or danger warnings).

3. 7C’s of Effective Communication:

To communicate professionally, follow these seven principles:

- Clear: Be clear about what you want to say.
- Concise: Use simple words and say only what is needed.
- Concrete: Use exact words and facts.
- Correct: Use correct spelling and grammar.
- Coherent: Words should make sense and relate to the topic.
- Complete: Include all required information.
- Courteous: Be respectful, friendly, and honest.

4. Feedback in Communication

Feedback is the acknowledgement that a message has been received and understood.

Types of Feedback:

- **Positive**: Encouraging comments like "Great job!"
- **Negative**: Highlighting mistakes, such as "You take too long to reply to emails."
- **No Feedback**: This is also a form of feedback, often showing disagreement.

A Good Feedback is:

- **Specific**: Avoid general comments; use examples.
- **Timely**: Give it promptly while the event is fresh.
- **Polite**: Use language that is not offensive.
- **Supportive**: Offer help after giving the feedback.

Importance of Feedback

- It validates effective listening by confirming the message was understood
- Improves performance by helping individuals make better decisions
- Motivates individuals to build better work relationships and continue high-quality work
- Boosts learning by keeping individuals focused on goals and aiding in better planning
- Always present in every interaction, making it an unavoidable part of communication

Descriptive Feedback: Feedback given through written comments or conversations that explain strengths and suggest improvements.
Example:

- "Your speech was clear and confident, but try to speak a little louder."

5. Barriers to Communication
Barriers are things that stop a message from being understood correctly:

- **Physical Barriers**: Environmental conditions (e.g., not being able to see gestures over a text message).
- **Linguistic Barriers:** Slang, professional jargon, or different languages.
- **Interpersonal Barriers**: Fear of speaking, lack of will to talk, or personal differences.

- **Organisational Barriers**: Rigid rules or formal hierarchies in a workplace.
- **Cultural Barriers**: Not understanding someone's customs or making stereotypical assumptions.

To overcome communication barriers, follow these measures:

- Use simple language.
- Do not form assumptions based on culture, religion, or geography.
- Communicate in person as much as possible.
- Use visuals to help convey the message.
- Use a translator to bridge language differences.
- Be respectful of others' opinions.

6. Writing Skills:

Basic Rules of Capitalisation (The TINS Rule):

T (Titles): Capitalise titles before names (e.g., Mr. Khan).
I: Always Capitalise the word "I" when used as a pronoun.
N (Names): Capitalise names of people, places, days, and months.
S (Starting): Capitalise the first letter of every sentence.

Parts of Speech:

- Noun: Naming words (e.g., Tiger, India).
- Pronoun: Replaces a noun (e.g., He, She, They).
- Adjective: Describing words (e.g., Large, Red).
- Verb: Action words (e.g., Run, Think).
- Adverb: Describes how an action is done (e.g., Quickly, Always).

Supporting Parts of Speech

- Articles: Used before nouns (a, an, the).
- Conjunctions: Join words, phrases, or sentences (and, but, because)
- Prepositions: Connect words to show where, when, or how (on, over, in, under)
- Interjections: Express strong emotions (Wow! Help!)

Active and Passive Sentences:

- Active Voice: The subject does the action (e.g., "Ram is reading a book").
- Passive Voice: The subject receives the action (e.g., "A book is being read by Ram").

Types of Sentences:

- Declarative: States a fact (ends with a period).
- Interrogative: Asks a question (ends with a question mark).
- Exclamatory: Expresses strong emotion (ends with an exclamation mark).
- Imperative: Shows an order or request (ends with a period or exclamation mark).

MULTIPLE CHOICE QUESTIONS

1. Which of the following is NOT an element of communication within the communication process cycle? [NCERT]
   (a) Channel (b)Receiver
   (c) Sender (d)Time
2. Which of these is a positive (good) facial expression? [NCERT]
   (a) Frowning while concentrating
   (b) Maintaining eye contact
   (c) Smiling continuously
   (d) Rolling up your eyes
3. Which of these are examples of positive feedback? [NCERT]
   (a) Excellent, your work has improved.
   (b) I noticed your dedication towards the project.
   (c) You are always doing it the wrong way.
   (d) All of the above
4. Which of these is NOT a common communication barrier? [NCERT]
   (a) Linguistic
   (b) Interpersonal
   (c) Financial
   (d) Organisational
5. Which of these sentences is capitalized correctly? [NCERT]
   (a) Ravi and i are going to the movies.
   (b) Salim is visiting India in july.
   (c) The Tiger is a strong animal.
   (d) She is arriving on Monday.
6. Identify the object, verb and subject in the sentence, 'The car crashed into a tree.' [NCERT]
   (a) Object: a tree; Verb: crashed; Subject: the car
   (b) Object: The car; Verb: crashed; Subject: a tree
   (c) Object: crashed; Verb: the tree; Subject: the car
   (d) Object: crashed; Verb: the car; Subject: the tree
7. Identify the imperative sentence: [CBSE 2026]
   (a) Shut the front door.
   (b) She is talented artist.
   (c) Are you feeling better?
   (d) You were amazing!
8. Which of these sentences is in active voice? [NCERT]
   (a) A movie is being watched by them.
   (b) The car was repaired by Raju.
   (c) He is reading a book.
   (d) The thief was being chased by a policeman.
9. Which of these are ways to overcome communication barriers? [NCERT]
   (a) Respecting each other's differences
   (b) Using a translator
   (c) Not communicating at all
   (d) Using your own language for comfort
10. Which of the following is an example of verbal communication? [CBSE Compt. 2026]
    (a) Gestures
    (b) Facial expressions
    (c) Written letters
    (d) Posture
11. A person is giving a speech to a large gathering during an election campaign. According to the sources, this is an example of which type of verbal communication?

(a) Interpersonal Communication
(b) Written Communication
(c) Small Group Communication
(d) Public Communication

12. When someone speaks very fast, it may indicate happiness, excitement, or nervousness. This element of non-verbal communication, which includes the tone, speed, and volume of a voice, is called:
    (a) Gestures
    (b) Paralanguage
    (c) Body Language
    (d) Expressions
13. Why feedback is considered a vital part of the communication cycle?
    (a) It acts as a barrier to the sender's message.
    (b) It validates effective listening and completes the cycle.
    (c) It ensures the message is never received.
    (d) It makes the process of listening unnecessary.
14. In a professional setting, a manager ensures they give feedback promptly so it doesn't lose its impact. This follows which component of good feedback?
    (a) Specific
    (b) Timely
    (c) Polite
    (d) Support-based
15. A team is unable to communicate effectively because their office is located in a very noisy environment that makes it hard to hear each other. This is an example of a:
    (a) Linguistic barrier
    (b) Organisational barrier
    (c) Physical barrier
    (d) Cultural barrier
16. Which of the "7 Cs" of effective communication emphasizes that a message should be respectful, friendly, and honest?
    (a) Clear
    (b) Concrete
    (c) Coherent
    (d) Courteous
17. In the sentence, "Hooray! We won the match," the word "Hooray" is used to express strong emotion. Which part of speech is this?
    (a) Preposition
    (b) Interjection
    (c) Conjunction
    (d) Adverb
18. Which of the following types of communication takes place when the number of people is small enough to communicate with each other effectively? [CBSE 2025]
    (a) Interpersonal communication
    (b) Public communication
    (c) Intrapersonal communication
    (d) Small group communication
19. Which of these sentences is written in the Passive Voice?
    (a) He is reading a book.
    (b) The entire house was painted by Ravi.
    (c) She bought a bicycle.
    (d) Ravi painted the entire house.
20. A supervisor gives an order to a staff member by saying, "Respond immediately." Which type of sentence is this?
    (a) Declarative sentence
    (b) Interrogative sentence
    (c) Exclamatory sentence
    (d) Imperative sentence

ANSWERS

1	2	3	4	5	6	7	8	9	10
d	b	a,b	c	d	a	a	c	a,b	c
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
d	b	b	b	c	d	b	d	b	d

SHORT ANSWER QUESTIONS (2 MARKS)

Q1. What is communication? Explain briefly.

Ans: Communication is the process of exchanging information, ideas, thoughts, or feelings between two or more people. It helps in understanding and building relationships by sharing messages clearly.

Q2. Differentiate between verbal and non-verbal communication.

Ans: Verbal communication uses spoken or written words to convey a message, such as talking or writing a letter. Non-verbal communication uses body language, gestures, facial expressions, and tone of voice to communicate without words.

Q3. Explain the three essential parts of communication.

Ans: Communication involves **transmitting**, where the sender sends a message through a medium; **listening**, where the receiver understands the message; and **feedback**, where the receiver conveys their understanding to the sender to complete the cycle.

Q4. What is 'Paralanguage' in non-verbal communication?

Ans: Paralanguage refers to **how we speak** and includes the **tone, speed, and volume** of our voice.

Q5. Describe the importance of feedback in the communication process.

Ans: Feedback is vital because it **validates effective listening**, **motivates people** to build better work relationships, helps **rectify errors**, and keeps individuals **focused on their goals**.

Q6. What is the difference between a sentence and a phrase?

Ans: A **sentence** is a group of words that communicates a **complete thought**, while a **phrase** is a group of words that **does not make complete sense** on its own.

Q7. If you are a team leader of a team of 20 people in an organization, mention any two methods that you will use for effective communication with your team members. [CBSE 2025]

Ans: There are different methods of communication: non-verbal, verbal and visual. However, all these methods can only be effective if we follow the basic principles of professional communication skills. These can be abbreviated as 7 Cs i.e., Clear, Concise, Concrete, Correct, Coherent, Complete and Courteous.

The examples of various methods of communication are: Notices/Posters, E-mail etc.

Q8. Define visual communication and provide one example.

Ans: Visual communication involves exchanging messages **only through images or pictures**, which makes it consistent across different places; an example is a **"No Entry" or "Danger" sign**.

No Parking

Q9. Write the 7C's of communication. [CBSE 2026]

7C's of effective communication are Clear, Concise, Concrete, Correct, Coherent, Complete, Courteous.

Q10. What are the factors that influence the selection of communication method?

Ans: Choosing the right method of communication depends on

a) target audience b) costs c) kind/type of information d) urgency/priority

Q11. A supervisor tells an employee, "You keep forgetting to smile at the hotel guests when you talk to them." Identify the type of feedback given and explain its purpose.

Ans: This is an example of negative feedback. Its purpose is to rectify errors by pointing out a specific behavior that needs to be corrected to improve performance.

Q12. A local sales executive is trying to explain the features of a new laptop to a customer from another country who speaks a different language. What type of barrier is this, and how can it be overcome?

Ans:

- This is a linguistic barrier, caused by the inability to communicate using a common language.
- To overcome this communication gap, consider using a translator or utilizing visual tools like images and signs

Q13. Radha's co-worker needs to give her feedback on time management because a report they were working on together was delayed. What are two qualities of "good feedback" the co-worker should use?

Ans:

Specific: The co-worker should avoid general comments and provide specific examples of when time was managed poorly. **Polite:** The feedback should be delivered in a way that ensures Radha does not feel offended by the language used.

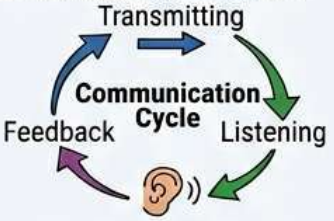
Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz Link : https://forms.gle/a4tEsUv9W7w2dydN9

COMMUNICATION SKILLS

SECTION 1
INTRODUCTION TO COMMUNICATION

Meaning:
Communication comes from the Latin word communicare, meaning 'to share'.



Elements of communication:

SECTION 2
METHODS OF COMMUNICATION

a. Verbal Communication
- Uses words and language

Types:
- Interpersonal
- Written
- Small Group
- Public

b. Non-Verbal Communication
- Communication without spoken or written
- 93% of communication is non-verbal

Types:
- Facial expressions
- Gestures
- Paralanguage
- Posture
- Eye contact

c. Visual Communication
- Communication using images and symbols

Examples:

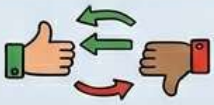
SECTION 3
THE 7 Cs OF EFFECTIVE COMMUNICATION

- **Clear:** Be clear about what you want to say.
- **Concise:** Use simple words and say only what is needed.
- **Concrete:** Use exact words and facts.
- **Correct:** Use correct spelling and grammar.
- **Coherent:** Words should make sense and relate to the topic.
- **Complete:** Include all required information.
- **Courteous:** Be respectful, friendly, and honest.

SECTION 4
FEEDBACK IN COMMUNICATION

Meaning:
Feedback is the acknowledgement that a message has been received and understood.

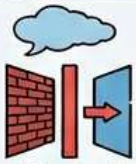
Types:
- Positive
- Negative
- No Feedback



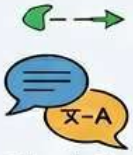
Characteristics of Good Feedback:
- Specific
- Timely
- Supportive
- Polite

Importance:
- Improves understanding
- Boosts learning
- Motivates people

SECTION 5
BARRIERS TO COMMUNICATION



Physical Barriers



Linguistic Barriers

Interpersonal Barriers

Organisational Barriers

Cultural Barriers

SECTION 6
WRITING SKILLS: BASIC RULES

TINS Rule
- Titles
- 'I'
- Names

'I'

S Starting letter of sentences

Parts of Speech:
- Noun
- Pronoun
- Verb
- Adjective
- Adverb

Supporting Parts
- Articles
- Conjunctions
- Prepositions
- Interjections

Active vs Passive Voice
The cat chased the mouse.
Passive Voice: The mouse was chased by the cat.

Types of Sentences
- Declarative
- Interrogative
- Exclamatory
- Imperative

UNIT 2 - SELF MANAGEMENT SKILLS II

What is Self – Management?

Self-management, also known as self-control, is the ability to manage emotions, thoughts, and behaviour effectively in different situations. It also includes motivating oneself and setting goals. People with strong self-management skills can handle responsibilities more efficiently and succeed in life.

Following are some of the skills you must master to succeed in life:

- ✓ Self-awareness
- ✓ Responsibility
- ✓ Time Management
- ✓ Adaptability

Importance of Self-Management:

- Self-sufficient and independent
- Ownership and accountability lead to self-confident
- Goal-oriented and strategy maker
- Self-monitoring and discipline reinforce good habits and behaviours
- Organise life and remove **stress**

What is Stress?

Stress is the emotional, mental, physical, or social reaction to challenges or demands. These challenges are called stressors. Stressors are the reason for stress.

Always keep in mind the ABC of stress management

A: Adversity or the stressful event

B: Beliefs or the way you respond to the event

C: **Consequences** or actions and outcomes of the event

Three Steps to Manage Stress

- ➢ **Step 1: Be aware that you are stressed** : Look out for signs of stress, such as headache, sleeplessness, sadness, excessive worrying, nervousness, etc
- ➢ **Step 2: Identify what is causing you stress:** Find out the reason for your stress. Is it because of exams, family pressures, money issues, not eating good food, etc.?
- ➢ **Step 3: Apply stress management methods:** Use time management tools to manage your time well. Focus on the important tasks and get them done.

Here are a few simple stress management techniques.

- ✓ **Time management:** Proper time management is one of the most effective stress-relieving techniques.
- ✓ **Physical exercise and fresh air:** A healthy lifestyle is essential for students. Stress is generally lower in people who maintain a healthy routine. Doing yoga, meditation and deep breathing exercises help in proper blood circulation and relaxes the body.
- ✓ **Healthy diet:** Having a healthy diet will also help you reduce stress. Eating a balanced diet, such as Dal, Roti, vegetables and fruits will give you the strength to do your daily work efficiently.
- ✓ **Positivity:** Focusing on negative aspects of life will add more stress. Instead, learn to look at the good things and stay positive.
- ✓ **Organising academic life; no delaying:** By keeping class notes organised, finishing in assignments on time, and keeping track of all deadlines, stress can be reduced to a great extent.
- ✓ **Sleep:** We should get a good night's sleep for at least 7 hours so that your brain and body get recharged to function better the next day.
- ✓ **Holidays with family and friends:** Going to a relative's place, such as your grandparents' house or a new place during your summer vacations can help you break from the normal routine and come back afresh

Stress management can help you to

- Have a joyful life.
- Focus and complete tasks on time.
- Be a happy person as you are stress free.
- Be more energetic and spend quality time with your friends and family.

Ability to Work Independently

If you can become a calm and relaxed person, you will have the ability to work independently, which means:

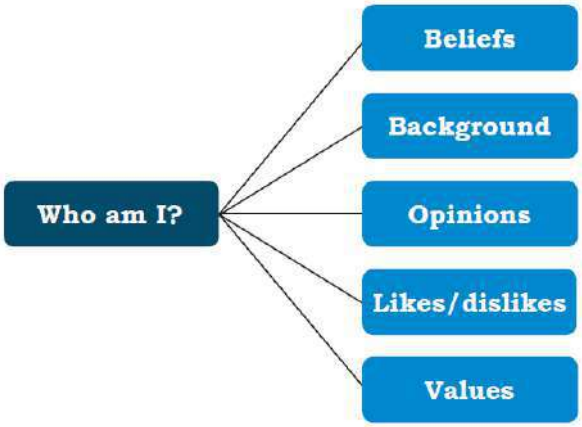
- Becoming self-aware, self-monitoring and self-correcting.

- Knowing what you need to do.
- Taking the initiative rather than being told what to do.
- Recognising your mistakes and not blaming others.
- Having the ability and the will to learn continuously

Self-Awareness

Being self-aware means that you can identify your strengths and weaknesses

Know Yourself: Belief, Background, Opinion, Choice, Values



Realising Strength and Weakness:

- Identify skills, abilities, interests, what you are good at and successful
- Identify shortcomings, apathies, where you face difficulty and defeat
- Consider honest feedback from others
- Continue practising skills
- Overcome weakness and improvise

Self-motivation

Self-motivation is simply the force within you that drives you to do things. Self-motivation is what pushes us to achieve our goals, feel happy and improve our quality of life.

Types of Motivation

- ***Internal Motivation (LOVE):*** We do things because they make us happy, healthy and feel good.
- ***External Motivation(REWARD) :*** We do things because they give us respect, recognition and appreciation

Qualities of Self-Motivated People:

- Aware of expectations from life
- Focused towards goal
- Aware of importance of things
- Dedicated to fulfil dream

Know what they want from life

Are focussed

Know what is important

Are dedicated to fulfill their dreams

Self-regulation

Self-regulation is the ability to manage your thoughts, emotions, and behaviours in ways that help you **achieve goals**, stay aligned with your values, and adapt to different situations.

Goal setting: It is a very essential factor in your personal life. The process of goal setting in your life helps you decide on how to live your life, where you want to be, and how you want to be in the future. It is all about finding and listing your goals and then planning on how to achieve them

Goals: They are a set of dreams with a deadline to get them, for example, saving pocket money to buy a favourite mobile phone by a particular date.

How to Set Goals?

We can use **SMART** method to set goals. SMART stands for

- **Specific**: A specific and clear goal answers six questions.
  1. **Who** is involved in the goal?
  2. **What** do I want to do?
  3. **Where** do I start?
  4. **When** do I start and finish?
  5. **Which** means do I use?
  6. **Why** am I doing this?
- **Measurable** : A measurable goal answers the questions
  - "How much?",
  - "How many?" and
  - "How do I know that I have achieved results?"
- **Achievable:** Breaking down big goals into smaller parts will make the goal achievable

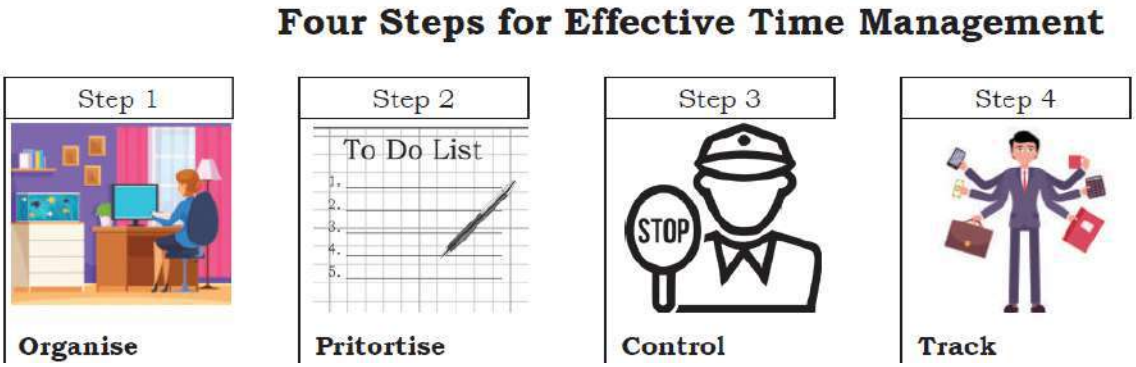
- **Realistic**: A realistic goal would be something that we want to achieve and can work towards.
- **Time bound:** A SMART goal should have a timeframe by when the goal needs to be achieved.

Self-regulation — Time Management

Time management is the ability to plan and control how you spend the hours of your day well and do all that you want to do.

Time management is the thinking skill that helps you to

- Complete tasks on time.
- Make a daily timetable.
- Make a good guess at how long it will take you to do something.
- Submit homework and assignments on time.
- Not waste time during the day.



Four Steps for Effective Time Management

1. **Organise:** We plan our day to- day activities.
2. **Prioritise:** We make a to-do list that has all our activities and we rank them in the order of importance.
3. **Control**: We have a control over our activities and time.
4. **Track:** We identify and note where we have spent our time.

MULTIPLE CHOICE QUESTIONS (MCQS)

Q1. Parvathi gets up at 4.30 am and goes to her badminton classes. Then she comes home and finishes her homework before going to school. She does this all by herself. No one tells her to do it. This is an example of

a) Self-motivation
b) External motivation
c) Both self and external motivation
d) Not any specific type of motivation

Q2. Which of the following can cause stress?

a) Yoga and meditation
b) Driving during rush hour
c) Organized academic life
d) Enjoying holidays with family

Q3. _____ is a series of postures and breathing exercises practiced to achieve control of body and mind.

a) Meditation b)NatureWalk
c) Yoga d) Physical Exercise

Q4._____ is not the quality of self-confident people.

a) Dependent
b) Hard Working
c) Positive Attitude
d) Commitment

Q5. _____ability of a person to do the things that need to be done without someone or something influencing us.

a) Self-Motivation
b) Self Discipline
c) Self Awareness
d)Self-Regulation

Q6. Deepika is always tense during exam time. She is a sincere and studious student, but the thought of exams creates anxiety in her. Which stress management technique that you would suggest to help her?

a) Yoga b) Exercise
c) Vacation with Family
d) All of these

Q7. Gokul participated in a 100m race and won a prize. What type of motivation is this?

a) Internal
b) External
c) Both Internal and External
d) None of these

Q8.Manoj is able to control his emotions, thoughts and behavior effectively in different situations. Identify his skill.

a) Stress management.
b) Self-control.
c) Self-awareness.
d) None of these

Q9. At the mental level which symptoms may reflect stress?

a) Irritation b) Impatience

c) Loneliness d) All of these

Q10. _____ refers to focusing human efforts for maintaining a healthy body and mind capable of better withstanding stressful situations.

a) Self-Motivation

b) Stress Management

c) Self-Awareness

d)Self-Regulation

Q11.High expectations from self can leave with chronic anxiety and stress, thus leading to _____ stress.

a) Physical b) Emotional

c) Mental d) Financial

Q12. 'Prepare yourself for new changes, so that you can transition seamlessly'. Which term can you relate the given sentence to?

a) Self-awareness

b) Responsibility

c) Adaptability

d) Time-management

Q13. _____ the work is all about identifying and noting how we spent our time, and analysing how to spend our time effectively.

a) Organising b) Prioritising

c) Controlling d) Tracking

Q14. What are the ABC of Stress Management?

a) Avertible, Belief, Consequences

b) Adversarial, Being, Control

c) Adversity, Belief, Consequences

d) Adversity, Belief, Control

Q15. Which ancient practice includes a series of postures and breathing exercises practiced to achieve control of body and mind?

a) Meditation

b) Physical Exercise

c) Listening music

d) Yoga

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
a	b	c	a	a	d	b	b
Q9	Q10	Q11	Q12	Q13	Q14	Q15	
d	b	c	c	d	c	d	

SHORT ANSWER QUESTIONS (1 MARK / 2 MARKS)

Q1. What is the importance of setting goals in life?

Answer

1. The process of goal setting in your life helps you decide on how to live your life, where you want to be, and how you want to be in the future.
2. It helps you to focus on the end result instead of less important work.
3. This will make you successful in your career and personal life.

Q2. In SMART goals, what does 'R' stand for? Explain.

Answer

'R' stands for Realistic. A realistic goal would be something that we want to achieve and can work towards. For example, "I spend 3 hours every day of the year after school to revise my subjects to get good marks in the exams."

Q3. How is self-regulation connected to the ability to work independently?

Answer

The ability to work independently can be enhanced by being self-regulated. Self-regulation guides independent individuals as it help them to consider long term consequences rather than just transient feelings. It leads to a responsible and a value driven behaviour. It teaches self-control and well-directed efforts to reach the goal. Self-regulated includes discipline that helps in consistent efforts to move towards the goal

Q4. Stress management can help someone in following ways: (any two)

Answer

i. He/she can have a joyful life
ii. He/she can focus and complete tasks on time
iii. He/she can be a happy person as he/ she is stress free.
iv. He/ she can be more energetic and spend quality time with your friends and family

Q5. State any two recreational activities which can help individuals transcend to a happier mental state and help manage stress.

Answer

Recreational activities like watching movies, attending concerts, playing games, involving in adventure sports, singing, dancing or even sketching can help individuals transcend to a Happier mental state and help manage stress

Q6. Mr Manish have to perform his best in the next cricket match so to get a chance to play for his school at the national level cricket tournament. He have been anxious (worried or stressed) for the upcoming match Give him any two benefits of stress management which makes it vital for him to perform.

Answer

- Improves mood
- Boosts immune system
- Promotes longevity
- Leads to burst of physical strength, which is vital for goal achievement
- Complete mental and physical engagement for task accomplishment
- Increases efficiency and effectiveness
- Prevents psychological disorders and behavioral problems

Q7. All people look forward to vacations for de-stressing and rejuvenation. State any other two ways by which people can manage stress Ways for stress management (any two):

Answer:

i. **Physical exercise :** Physical exercise in the form of walking, skipping or any sports relieves stress by stabilizing mood, improving self -esteem and inducing sleep.

ii. **Yoga :** Yoga includes a series of postures and breathing exercises practiced to achieve control of body and mind.

iii. **Meditation :** By meditation, an individual is able to focus his/her mind to achieve a calm mental state reducing stress.

iv. **Enjoying** : Recreational activities such as watching movies, attending concerts, playing games singing, dancing, sketching etc help individuals transcend to a happier mental state and help manage stress.

Q8. What is self-motivation?

Answer

Self-motivation is simply the force within you that drives you to do things. Self-motivation is what pushes us to achieve our goals, feel happy and improve our quality of life. In other words, it is our ability to do the things that need to be done without someone or something influencing us

Q9. Enlist any two advantages of stress management. Stress management can help someone in following ways: (any two)

Answer

i. He/she can have a joyful life

ii. He/she can focus and complete tasks on time

Q10. Define the term "Time-Management" **[CBSE 2026]**

Answer

Time Management is the ability to plan and control how you spend the hours of your day well and do all that you want to do.

Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz Link : https://forms.gle/UbNpT1xR5Luni6X36

Self-Management Skills

1 SELF-MANAGEMENT

Managing your emotions, thoughts and behaviour effectively to achieve goals and succeed in life.

KEY SKILLS

- Self-awareness
- Responsibility
- Time Management
- Adaptability

IMPORTANCE

- ✓ Self-sufficient and independent
- ✓ Builds confidence through ownership and accountability
- ✓ Goal-oriented and strategy maker
- ✓ Self-monitoring and discipline build good habits
- ✓ Organise life and remove stress

2 STRESS MANAGEMENT

Handling stress in a healthy way to maintain physical, mental, and emotional well-being.

ABC OF STRESS MANAGEMENT

- **A** Adversity (The stressful event)
- **B** Beliefs (The way you respond)
- **C** Consequences (Actions and outcomes)

THREE STEPS TO MANAGE STRESS

1. **Be aware that you are stressed** Look for signs: headache, sadness, sleeplessness, worrying, etc.
2. **Identify what is causing stress** Find the reason: exams, family pressure, health, money issues, etc.
3. **Apply stress management methods** Use time management tools and focus on important tasks.

STRESS MANAGEMENT TECHNIQUES

- **Time Management** – Plan time well to reduce pressure and stay productive.
- **Exercise & Fresh Air** – Yoga, meditation and deep breathing relax the body and mind.
- **Healthy Diet** – Eat balanced food (dal, roti, vegetables, fruits) for good health and energy.
- **Positivity** – Focus on the good things in life and stay positive.
- **Organise Academic Life** – Keep notes, complete assignments on time and track deadlines.
- **Sleep** – Get at least 7 hours of sleep for better focus and energy.
- **Holidays with Family & Friends** – Take breaks, spend time with loved ones and refresh yourself.

STRESS MANAGEMENT HELPS YOU

- Be a joyful and healthy person
- Focus and complete tasks on time
- Have more energy
- Spend quality time with family and friends

3 ABILITY TO WORK INDEPENDENTLY

Being self-reliant, taking initiative and completing tasks with responsibility and confidence.

CHARACTERISTICS

- Self-aware, self-monitoring and self-correcting
- Know what needs to be done
- Take initiative
- Recognise mistakes and learn from them
- Have the ability and will to learn continuously

SELF-AWARENESS

Being self-aware means identifying your strengths and weaknesses.

Belief · Background · Opinion · Choice · Values

REALISING STRENGTHS AND WEAKNESSES

- Identify skills, abilities, interests and successes
- Identify shortcomings and areas of difficulty
- Take honest feedback from others
- Continue practising skills
- Overcome weakness and improvise

SELF-MOTIVATION

The inner drive that pushes you to achieve goals and improve life.

TYPES OF MOTIVATION

- **Internal (LOVE)** Do things because they make you happy, healthy and feel good.
- **External (REWARD)** Do things to get respect, recognition and appreciation.

QUALITIES OF SELF-MOTIVATED PEOPLE

- Aware of expectations from life
- Focused towards goal
- Aware of importance of things
- Dedicated to fulfil dreams

4 SELF-REGULATION, GOAL SETTING & TIME MANAGEMENT

Managing your thoughts, emotions and behaviour to achieve goals and use time effectively.

GOAL SETTING

Goals are dreams with deadlines.

SMART METHOD FOR GOAL SETTING

- **S** Specific — A clear goal answers: Who? What? Where? When? Which means? Why?
- **M** Measurable — Answers: How much? How many? How will I know I achieved it?
- **A** Achievable — Break big goals into smaller, achievable steps.
- **R** Realistic — The goal should be practical and within reach.
- **T** Time-Bound — Set a clear time frame or deadline.

TIME MANAGEMENT

The ability to plan and use time effectively to complete tasks.

IMPORTANCE OF TIME MANAGEMENT

- Complete tasks on time
- Encourages daily planning
- Better estimation of time for tasks
- Timely submission of work
- Prevents wastage of time

FOUR STEPS FOR EFFECTIVE TIME MANAGEMENT

1. **Organise** Plan your daily activities and schedule.
2. **Prioritise** Arrange tasks according to importance.
3. **Control** Control your activities and time usage.
4. **Track** Monitor how your time is being spent.

REMEMBER

Self-management is the key to a balanced, successful and happy life. Manage your mind, time and actions to achieve your dreams!

Know Yourself · Stay Positive · Set Goals · Manage Time · Stay Healthy · Keep Learning · Be Responsible · Succeed in Life

UNIT- 3

INFORMATION AND COMMUNICATION TECHNOLOGY SKILLS – II

The Significance of Developing ICT Proficiency

Gaining and improving **ICT (Information and Communication Technology)** skills is vital for **efficient communication**, **smooth business processes**, and staying **connected with others**. As technology rapidly evolves, it becomes imperative for individuals to **consistently update their skills** to adapt to new **applications** and **software tools**.

Components of a Computer System

A computer consists of two main categories:

- **Hardware**: These are the **tangible** elements like the **monitor**, **keyboard**, and **CPU** that you can physically interact with.
- **Software**: These are **intangible** elements that allow the hardware to operate.

Operating System (OS)

The **OS acts as a bridge** between the user and computer, managing resources and executing programs. It performs several **critical roles**:

1. Monitors hardware and its usage.
2. Ensures smooth functioning of hardware components.
3. Manages software applications.
4. Allocates and monitors memory usage for each task.
5. Organizes system files and folders.
6. Keeps track of disk usage.
7. Facilitates **file operations** like creating, copying, moving, and deleting files.

Types of Operating Systems

- **Single-user, single-task OS**: Handles one task by a single user at a time.
- **Single-user, multi-task OS**: Common in laptops and desktops; allows multiple applications to run concurrently (e.g., **Windows**, **macOS**).
- **Multi-user OS**: Supports multiple users on the same system, simultaneously or sequentially.
- **Real-time OS**: Designed for **time-sensitive operations** (e.g., **Lynx OS**, **Windows CE**).
- **Distributed OS**: Connects multiple computers over a network to function as one system (e.g., **UNIX**, **Linux**, **Windows**).
- **GUI-based (Graphical User Interface) OS**: Enables interaction through mouse clicks and visuals, like **Windows**.

Understanding Windows Desktop Elements

- **Taskbar**: Located at the screen's bottom, containing the **Start button** on the left and **time/date** on the right, along with shortcut icons.
- **Start Button**: Gives access to various programs and system settings.
- **Recycle Bin**: Temporarily stores deleted files and folders for recovery before permanent deletion.

Managing Files and Folders

- **File**: A unit of data saved on the computer.
- **Folder**: A container to organize files and even other folders (**subfolders**).

Creating a File:

1. Right-click in an empty area.
2. Select **New > File type** (e.g., Text Document, Word).

Renaming:

- Right-click > **Rename**, or
- Select and press **F2**.

Creating a Folder:

1. Open "This PC" or "Computer".
2. Choose the drive (e.g., Local Disk D:).
3. Click **New Folder** on the toolbar.
4. Enter a name when prompted.

Deleting:

- Select file/folder > Press **Delete**, or
- Right-click > Choose **Delete**.

Essential Keyboard Shortcuts

- **CTRL + Z** – Undo
- **CTRL + Y** – Redo
- **CTRL + A** – Select All
- **CTRL + X** – Cut
- **CTRL + C** – Copy
- **CTRL + V** – Paste
- **CTRL + P** – Print
- **CTRL + S** – Save

Basic Computer Care and Maintenance

Regular upkeep ensures that the system runs smoothly and lasts longer.

General Tips:

1. **Keep the system clean** and dust-free.
2. **Avoid eating/drinking** near the computer.
3. Wash hands before using peripherals.
4. Store **CDs/DVDs** properly.
5. Use a **cover for the keyboard** when not in use.

Cleaning Hardware Components

- **Turn off the system** before cleaning.
- Never spray liquid directly—**apply it on a cloth** first.
- Use **anti-static tools** to prevent damage.

Specific Components:

- **Monitor**: Use soft, lint-free cloth and avoid liquid contact with seams.
- **Keyboard**: Shake gently upside down to remove debris.
- **Mouse**: Clean the lens and surface with a dry cloth or air.
- **CD/DVDs**: Clean in a circular motion from center outward.

Maintenance Schedule

Daily:

- Organize emails.
- Download and store attachments properly.

Weekly:

- Clean keyboard and monitor.
- Dust CPU and printer.
- Backup data to external drive.

Monthly:

- Transfer and organize photos.
- Clean the 'Downloads' folder.
- Uninstall unused apps.
- Run virus and disk cleanup scans.

Yearly:

- Update OS and antivirus.
- Clean up contact lists.
- Check hardware for replacements.

Backup and Recovery

- Back up essential data to **CD/DVDs**, **external drives**, or **cloud**.
- Regular backups ensure **data safety** during crashes or disasters.

System Optimization

- Clean **temporary files** (use **%temp%** via Windows + R).
- Remove **unwanted emails and SPAM**.
- Uninstall unnecessary programs.
- Limit background apps for better speed.

Threats to Computer Systems

- **Physical Theft**: Hardware stolen.
- **Identity Theft**: Personal data is misused.
- **Software Piracy**: Unauthorized software usage.
- **Virus**: Damages or steals data.

Types of Viruses:

- **Worms**: Self-replicating and widespread.
- **Trojan Horse**: Disguised as helpful but is destructive.

Cyber security Measures

- Use **strong passwords** with a mix of characters.
- **Install antivirus** and **firewalls**.
- **Encrypt data** using tools like **BitLocker**.
- Use **HTTPS websites** for safe transactions.

Online Safety Risks

- **Online Predators**: Pretend to be friends to manipulate or exploit.
- **Internet Scams**: Fake lottery wins or offers to steal money and data.

MULTIPLE CHOICE QUESTIONS

Q1. **Which of the following is an example of system software?**

a) MS Excel b) Windows 10

c) Adobe Photoshop d) VLC Player

Q2. **What is the shortcut key to paste copied content?**

a) Ctrl + C b) Ctrl + V

c) Ctrl + X d) Ctrl + Z

Q3. **The Recycle Bin in Windows stores deleted files for how long?**

a) Permanently deletes instantly

b) Stores temporarily until emptied

c) Stores for 30 days only

d) None of the above

Q4. **What does an operating system do?**

a) Manages hardware and software resources

b) Helps to create documents

c) Provides antivirus protection

d) Manages internet speed

Q5. **Which of the following is NOT an operating system?**

a) Windows b) Linux

c) Microsoft Word d) macOS

Q6. **Which key combination is used to undo the last action?**

a) Ctrl + Y b) Ctrl + Z

c) Ctrl + S d) Ctrl + A

Q7. **Which of the following protects a computer from unauthorized access?**

a) Firewall b) Keyboard

c) Printer d) Operating system

Q8. **What does Ctrl + S do in most applications?**

a) Save the file b) Select all content

c) Close the application d) Open a new window

Q9. **Which of the following is an example of application software?**

a) Linux b) MS Word

c) BIOS d) Windows 10

Q10. **What is the purpose of creating backups?**

a) To improve system speed

b) To recover lost data

c) To upgrade software

d) To delete unwanted files

Q11. **Which key combination is used to copy selected text or files?**

a) Ctrl + C b) Ctrl + V

c) Ctrl + X d) Ctrl + P

Q12. **Which of the following is NOT a preventive maintenance practice?**

a) Keeping software updated

b) Using antivirus software

c) Eating food near the computer

d) Cleaning hardware regularly

Q13. **Which hardware component is used for input?**

a) Monitor b) Keyboard

c) Speaker d) Printer

Q14. **What is the function of the Start button in Windows?**

a) Shuts down the computer

b) Opens the Start menu

c) Minimizes all windows

d) Opens Control Panel

Q15. Which key combination is used to cut selected content?

a) Ctrl + X b) Ctrl + C

c) Ctrl + V d) Ctrl + A

Q16. What does Ctrl + Z do?

a) Redo b) Copy c) Undo d) Paste

Q17. What does Ctrl + S do?

a) Save b) Print c) Select all d) Cut

Q18. Which extension does an image file usually have?

a) .mp3 b) .txt c) .jpg d) .doc

Q19. What happens if you leave a device plugged in even after it is charged 100%?

a) It can break b) It can stop functioning

c) It can overheat d) Data can get corrupt

Q20. How can an antivirus protect your device?

a) Protect from overheating

b) Increase performance

c) Prevent data from getting corrupt

d) Backup data

Q21. Which is not required to keep a device cool?

a) Keep the device unplugged when not in use

b) Do not cover laptop with blanket

c) Make sure CPU fan is working

d) Avoid leaving device in sun

Q22. What is essential for maintaining a keyboard?

a) Shake upside down

b) Blow dust

c) Use dilute soap solution

d) All of the above

Q23. What should you do if a program is not being used?

a) Keep it running b) Close it

c) Minimize it d) Restart computer

Q24. How often should you backup your data according to the weekly schedule?

a) Daily b) Weekly

c) Monthly d) Yearly

Q25. What is SPAM?

a) Antivirus software

b) Advertising or unwanted emails

c) A type of virus

d) A backup method

Q26. What should you do to ensure secure online transactions?

a) Lock your computer

b) Give details only on safe websites

c) Use antivirus

d) Do not use pirated software

Q27. Which of these trap small children into inappropriate relationships?

a) Online predators b) Worms

c) Trojan Horse d) Antivirus

Q28. What should a strong password consist of?

a) Only letters

b) Numbers and special characters

c) Name of a person

d) Letters, numbers, and special characters

Q29. Which virus replicates itself and spreads to all files?

a) Trojan Horse b) Worm

c) Spyware d) Adware

Q30. What does a Trojan Horse virus do?

a) Disguises as useful software

b) Overheats the computer

c) Backs up data

d) Cleans files

ANSWER KEY

1	2	3	4	5	6	7	8	9	10
b	b	b	a	c	b	a	a	b	b
11	12	13	14	15	16	17	18	19	20
a	c	b	b	a	c	a	c	c	c
21	22	23	24	25	26	27	28	29	30
a	d	b	b	b	b	a	d	b	a

SHORT ANSWER TYPE QUESTIONS (1 MARK / 2 MARK)

Q1. What is an operating system? Give two examples.

Answer: An operating system (OS) is software that manages computer hardware and software resources and provides common services for computer programs. Examples: Windows, Linux.

Q2. Explain the function of the Recycle Bin in Windows.

Answer: The Recycle Bin temporarily stores deleted files and folders, allowing users to restore accidentally deleted items or permanently delete them later.

Q3. Name any two preventive maintenance practices for a computer.

Answer: Regularly updating antivirus software to protect against malware.

Cleaning hardware components like keyboard and CPU to avoid dust buildup

.**Q4. What are system software and application software? Give one example each.** **Answer:** System software helps run the computer hardware and system (e.g., Operating System like Windows).

Application software performs specific tasks for users (e.g., Microsoft Word).

Q5. Why is it important to create backups of data?

Answer: Backups prevent data loss due to accidental deletion, hardware failure, or virus attacks by keeping copies of important files in a safe place.

Q6. What is the shortcut key to save a file? Explain its use.

Answer: The shortcut key to save a file is Ctrl + S. It quickly saves the current document or file without needing to use the mouse or menu options.

Q7. Explain the function of a firewall in computer security.

Answer: A firewall acts as a security barrier between a trusted network and untrusted networks, blocking unauthorized access and protecting the computer from malicious attacks.

Q8. Describe two functions of the Start menu in Windows.
Answer: Provides quick access to installed programs and applications. Allows users to search files, settings, and access system features.
Q9. What is the difference between 'Cut' and 'Copy' commands?
Answer: Cut removes the selected content from its original place and moves it to the clipboard. Copy duplicates the selected content without removing it and stores it in the clipboard.

Q10. List any two hardware components used for input and output.

Answer: Input hardware: Keyboard, Mouse Output hardware: Monitor, Printer

Q11. Why is computer security important?

Answer: To prevent loss or leakage of personal and financial information.

Q12. What is a security breach?

Answer: Leakage of information stored in a computer.

Q13. How does a Trojan Horse virus work?
Answer: It disguises itself as useful software but destroys data once inside.

Q14. List three ways to protect your data.
Answer: Use strong passwords, install antivirus/firewall, encrypt data, use secure websites.

Q15. What indicates a website is secure?
Answer: The address starts with https:// and shows a lock symbol.

Q16. What is software piracy?
Answer: Stealing or using/distributing unlicensed copies of software.

Q17. What is backing up data?
Answer: Saving information to another device (e.g., CD, hard disk) in case the computer fails.

Q18. How can you increase computer performance?

Answer: Remove unnecessary files and use disk cleaner software.

Q.19. Why do we use login IDs and passwords?

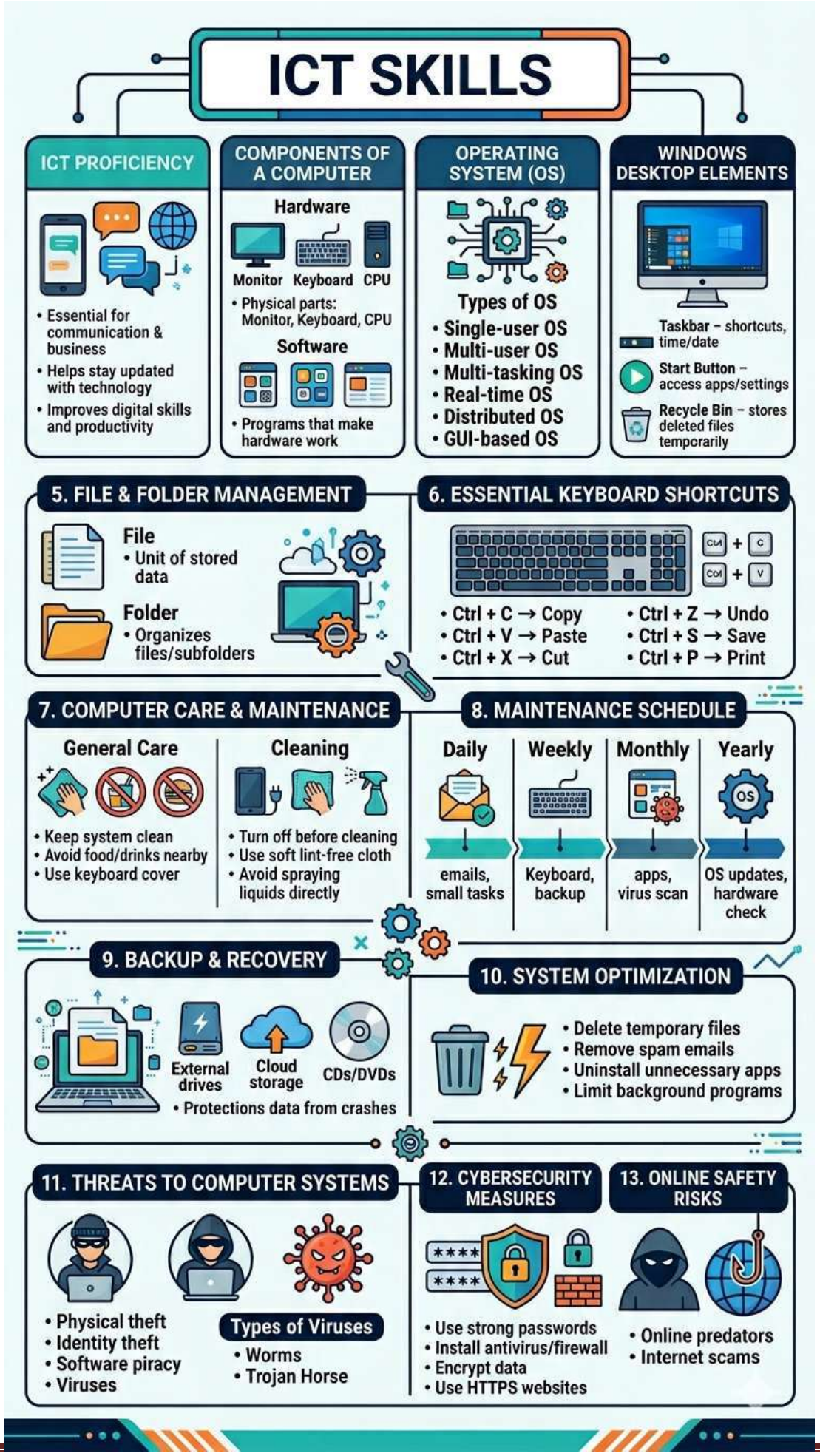
Answer: To prevent unauthorized access to our computer and information.

Q.20. What is the difference between hardware and software?

Answer: Hardware is the physical parts of a computer we can see and touch. Software is a set of instructions that makes hardware work

Hindi Audio	English Audio	Hindi Video	English Video	Quiz
				7

Quiz Link : https://forms.gle/DVR6RwFr24WDjazS


ICT SKILLS
ICT PROFICIENCY
• Essential for communication & business
• Helps stay updated with technology
• Improves digital skills and productivity
COMPONENTS OF A COMPUTER
Hardware
Monitor Keyboard CPU
• Physical parts: Monitor, Keyboard, CPU
Software
• Programs that make hardware work
OPERATING SYSTEM (OS)
Types of OS
• Single-user OS
• Multi-user OS
• Multi-tasking OS
• Real-time OS
• Distributed OS
• GUI-based OS
WINDOWS DESKTOP ELEMENTS
Taskbar – shortcuts, time/date
Start Button – access apps/settings
Recycle Bin – stores deleted files temporarily
5. FILE & FOLDER MANAGEMENT
File
• Unit of stored data
Folder
• Organizes files/subfolders
6. ESSENTIAL KEYBOARD SHORTCUTS
• Ctrl + C → Copy
• Ctrl + V → Paste
• Ctrl + X → Cut
• Ctrl + Z → Undo
• Ctrl + S → Save
• Ctrl + P → Print
7. COMPUTER CARE & MAINTENANCE
General Care
• Keep system clean
• Avoid food/drinks nearby
• Use keyboard cover
Cleaning
• Turn off before cleaning
• Use soft lint-free cloth
• Avoid spraying liquids directly
8. MAINTENANCE SCHEDULE
Daily
emails, small tasks
Weekly
Keyboard, backup
Monthly
apps, virus scan
Yearly
OS updates, hardware check
9. BACKUP & RECOVERY
External drives
Cloud storage
CDs/DVDs
• Protections data from crashes
10. SYSTEM OPTIMIZATION
• Delete temporary files
• Remove spam emails
• Uninstall unnecessary apps
• Limit background programs
11. THREATS TO COMPUTER SYSTEMS
• Physical theft
• Identity theft
• Software piracy
• Viruses
Types of Viruses
• Worms
• Trojan Horse
12. CYBERSECURITY MEASURES
• Use strong passwords
• Install antivirus/firewall
• Encrypt data
• Use HTTPS websites
13. ONLINE SAFETY RISKS
• Online predators
• Internet scams

UNIT - 4

ENTREPRENEURIAL SKILLS- II

ENTREPRENEURSHIP AND SOCIETY

How Entrepreneurs Help Society

1. **Fulfill Customer Needs**: They create **useful products/services** based on what people **need or want**.
2. **Use Local Resources**: They use **local materials and workers**, which **saves cost** and supports the **local economy**.
3. **Create Jobs**: As business grows, they **hire more people**, providing **employment**.
4. **Lower Prices Competition** among businesses **reduces product prices**.
5. **Better Living**: New and affordable products **improve lifestyle**.
6. **Boost Economy**: Business growth leads to **more income** and **nation's development**.

QUALITIES AND FUNCTIONS OF AN ENTREPRENEUR

Qualities of a Good Entrepreneur

- **Confidence**: They believe in their ideas and stick to them even when times are tough.
- **Innovative Thinking**: They come up with **new and smart ideas** that can change the way businesses work.
- **Creativity**: They try to find **better solutions** and improve products or services.
- **Patience**: They don't expect success overnight. They wait and keep trying.
- **Perseverance**: They **don't quit** when things get hard; they keep going.
- **Responsibility**: They **own their work** and make sure the business runs well.
- **Leadership**: They guide the team and **set goals** for the business.
- **Hard Work**: They put in **a lot of effort**, especially at the start.
- **Risk-taking**: They are ready to **take risks**, but only after thinking things through.
- **Never Give Up Attitude**: They keep trying even when they fail.

What Entrepreneurs Do (Functions)

- **Make Decisions**: They make all kinds of decisions—**technical, managerial, and strategic**.
- **Run the Business**: They **plan and manage** everything to keep the business going.
- **Handle Money**: They take care of payments, salaries, and business expenses.
- **Take Risks**: They take **calculated risks** after thinking about the possible rewards and losses.
- **Bring New Ideas**: They launch **new products or services** that can shake up the market.

MYTHS ABOUT ENTREPRENEURSHIP

Common Misconceptions (False Beliefs)

1. **"The idea must be unique"**

Not true! Even a common idea can work if you **do something differently**.

Example: inDrive allowed users to **negotiate fares** unlike Ola/Uber.

2. **"You need lots of money to start a business"**

Some businesses start with **small capital**.

Example: *Bittoo Tikki Wala* began on the street and grew by using profits.

3. **"Only big businesses count"**

Not true. Even a **small business** owner is an entrepreneur.

4. **"Entrepreneurs are born, not made"**

Wrong! **Entrepreneurship can be learned** and developed with practice and training.

Topic 4: Entrepreneurship as a Career Option

Steps in the Entrepreneurial Journey

1. **Entry Stage**: When the person **starts the business**.
2. **Survival Stage**: Competing in the **market to stay in business**.
3. **Growth Stage**: Expanding the business after it becomes stable.

Why Choose Entrepreneurship? (Advantages)

- **Freedom**: You're **your own boss**.
- **Satisfaction**: You can **follow your dreams**.
- **Wealth Creation**: You help the **economy grow** and earn profits.
- **Work-Life Balance**: You can **decide your own schedule**.

Challenges in Entrepreneurship (Disadvantages)

- **Risk**: You use your **own money and time**.
- **Workload**: It requires **a lot of effort** to start and run.
- **Difficulties**: You might have to face **stress, late nights, and lack of funding**.
- **Uncertainty**: The **market, laws, and customer needs** may change suddenly.

MULTIPLE CHOICE QUESTIONS

Q1. **Entrepreneurs contribute to society by**

a) Generating employment

b) Creating income and wealth

c) Improving standard of living

d) All of the above

Q2. **Which of the following is a quality of an entrepreneur?**

a) Confidence b) Laziness

c) Indecisiveness d) Procrastination

Q3. **Entrepreneurs take**

a) Uncalculated risk b) Calculated risk

c) No risk d) Random risk

Q4. **The money used to start a business is called :**

a) Loan b) Capital

c) Income d) Profit

Q5. **Entrepreneurs are : [CBSE-2026]**

a) Born, not made b) Made, not born

c) Both born and made d) None of the above

Q6. **Which of the following is not an entrepreneurial skill?**

a) Creativity b) Patience

c) Laziness d) Hard work

Q7. **An example of a cooperative society in India is :**

a) Reliance b) Amul

c) Tata d) Infosys

Q8. **The process of bringing new ideas to market is called :**

a) Innovation b) Imitation

d) Investment d) Development

Q9. **The stage when an entrepreneur expands business after stabilizing is called:**

a) Entry b) Survival

c) Growth d) Decline

Q10. **Which of the following is NOT a function of an entrepreneur?**

a) Managing the business

b) Taking risks

c) Avoiding decisions

d) Making decisions

Q11. **Entrepreneurs create jobs by:**

a) Selling products

b) Hiring people as business grows

c) Ignoring market trends

d) Avoiding competition

Q12. **What is the main reason entrepreneurs take calculated risks?**

a) To lose money

b) To avoid responsibilities

c) To get good rewards

d) To avoid work

Q13. **Which term means patience and continuing despite difficulties?**

a) Perseverance b) Laziness

c) Hesitation d) Fear

Q14. **The type of decision that involves company policies is called:**

a) Technical Decision

b) Managerial Decision

c) Strategic Decision

d) Routine Decision

Q15. **Entrepreneurs improve the standard of living by:**

a) Making better products

b) Increasing prices

c) Reducing work hours

d) Avoiding competition

Q16. What is the first step in starting a business?

a) Hiring employees

b) Making profits

c) Identifying a business idea or opportunity

d) Applying for a loan

Q17. Entrepreneurs help in reducing __

a) GDP b) Unemployment

c) Jobs d) Innovation

In the following questions (Q18 to Q20), a statement of Assertion (A) is followed by statement of Reason (R). Mark the correct choice as:

(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.

(e) Both A and R are false

Q18. Assertion (A): Entrepreneurs contribute to national development.

Reason (R): Entrepreneurs create job opportunities and promote innovation.

Q19. Assertion (A): Creativity is an essential trait of a successful entrepreneur.

Reason (R): Creativity helps in finding new solutions to customer problems and market needs.

Q20. Assertion (A): A successful entrepreneur does not need communication skills.

Reason (R): Communication skills are only required in jobs, not in business.

ANSWER KEY

1	2	3	4	5	6	7	8	9	10
d	a	b	b	c	c	b	a	c	c
11	12	13	14	15	16	17	18	19	20
b	c	a	c	a	c	b	a	a	e

SHORT ANSWER QUESTIONS (2 MARKS)

Q1: List any two qualities of a successful entrepreneur.

Answer: Two qualities of a successful entrepreneur are:

- Creativity: Ability to generate innovative ideas.
- Risk-taking: Willingness to take calculated risks.

Q2: Explain any two functions of an entrepreneur.

Answer: Two functions of an entrepreneur are:

- Innovation: Introducing new products or services.
- Organization: Assembling and coordinating resources effectively.

Q3: What is meant by 'risk-taking' in entrepreneurship?

Answer: Risk-taking in entrepreneurship refers to the willingness to undertake business ventures with uncertain outcomes, with the aim of achieving potential rewards.

Q4: Differentiate between 'innovation' and 'invention'.

Answer: Invention is the creation of a product or introduction of a process for the first time. Innovation is the improvement or significant contribution to an existing product, process, or service.

Q5: Mention any two benefits of being an entrepreneur.

Answer: Two benefits of being an entrepreneur are:

- Autonomy: Being your own boss.
- Financial rewards: Potential to earn profits from the business.

Q6: Explain the term 'self-motivation' in the context of entrepreneurship.

Answer: Self-motivation in entrepreneurship refers to the internal drive that propels an entrepreneur to initiate and sustain business activities without external encouragement.

7. Differentiate between wage employed people and self-employed people.
Answer:

Wage Employed People	Self-employed People
Work for a person or an organization	Start businesses to satisfy the needs of people
Get paid for the work they do	Run their own business
Example: A doctor working in a hospital	Example: A doctor running his/her own clinic

8. Brief the career process involved in becoming a successful entrepreneur with an example.
Answer:
Process :
Enter: When an entrepreneur is starting, they are just entering the market to do business.
Survive : There are many entrepreneurs in the market. The entrepreneur has to remain in a competitive market.
Grow: Once the business is stable, an entrepreneur thinks about expanding his or her business.
Example:
Sanjana starts a small grocery store in a locality with many competitors. Her store succeeds, expands to multiple floors, and later grows into a chain of stores across the city and other cities.

. 9. State any two myths about entrepreneurship.

Answer:

1. Every business idea needs to be unique or special.
2. Entrepreneurs are born, not made.

Q10: Define the term 'entrepreneur'.

Answer: An entrepreneur is an individual who identifies a need in the market, creates a business to fill that void, and assumes the risk and rewards of the venture.

Q11. Sunita saw that people in her neighborhood used plastic bags. She started making cloth bags from waste fabric and sold them at low prices. Shopkeepers liked the idea and began bulk buying. Her business now earns regular profit and supports two other workers.

(a) What social problem did Sunita address?

(b) Is Sunita a business entrepreneur or a social entrepreneur? Why?

(c) Name one entrepreneurial quality Sunita demonstrated.

(d) How does this business contribute to the community?

Answer:

(a) Excessive use of plastic and environmental pollution.

(b) She is both. She earns profit (business) while solving a social problem (social).

(c) Initiative and social responsibility.

(d) It promotes eco-awareness, reduces plastic use, and creates employment.

Q12. Krishna, a student, noticed that his classmates often forgot homework. He developed a simple mobile app to remind students of their assignments. He later added paid features and offered the app to other schools.

(a) What kind of innovation did Krishna use?

(b) Which entrepreneurial skill did Krishna demonstrate by launching the app in other schools?

(c) How can Krishna's idea benefit students?

(d) Suggest one risk Krishna might face and how to overcome it.

Answer:

(a) He used technological innovation by creating a mobile app to solve a daily problem. the files from anywhere, avoiding confusion.

(b) Opportunity seeking and decision-making.

(c) It helps them stay organized and improves time management and academic performance.

(d) Risk: Lack of users or technical issues. He can overcome it by testing the app properly and promoting it in schools.

Q13. Five students launched a business selling customized stationery. Each one handled a specific role — designing, finance, marketing, communication, and delivery. They maintained a profit-sharing model and worked together to grow the business.

(a) What entrepreneurial quality is shown in this case?

(b) Why is role division important in a business team?

(c) How does working in a team help in entrepreneurship?

(d) Suggest one way they can improve customer satisfaction.

Answer:

(a) Teamwork and collaboration.

(b) It ensures better productivity, clarity, and efficient work.

(c) It brings in diverse skills, ideas, and shared responsibilities, which leads to better decision-making.

(d) By collecting regular customer feedback and offering custom designs or loyalty discounts.

Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz link : https://forms.gle/KaJXazkkauKsonny8

ENTREPRENEURIAL SKILLS

ENTREPRENEURSHIP & SOCIETY

HOW ENTREPRENEURS HELP SOCIETY

FULFIL CUSTOMER NEEDS: Create useful products/services based on what people need/want.

USE LOCAL RESOURCES: Use local materials and workers, saves cost, supports local economy.

CREATE JOBS: As business grows, hire more people, providing employment.

LOWER PRICES: Competition reduces product prices.

BETTER LIVING: New and affordable products improve lifestyle.

BOOST ECONOMY: Business growth leads to more income and nation's development.

QUALITIES & FUNCTIONS OF AN ENTREPRENEUR

QUALITIES OF A GOOD ENTREPRENEUR

Confidence: Believe in ideas, stick to them

Innovative Thinking: New, smart ideas

Creativity: Find better solutions, improve products

Patience: Wait and keep trying

Perseverance: Don't quit when things get hard

Responsibility: Own work, ensure business runs well

Leadership: Guide team, set goals

Risk-taking Ready to take risks after thinking through

Never Give Up Attitude: when they fail

WHAT ENTREPRENEURS DO (FUNCTIONS)

Make Decisions Technical, managerial, strategic.

Run the Business Plan and manage everything

Handle Money Payments, salaries, expenses

Take Risks Calculated risks, rewards vs losses

Bring New Ideas Launch new products/ services, shake market

MYTHS ABOUT ENTREPRENEURSHIP

COMMON MISCONCEPTIONS (FALSE BELIEFS)

Myth	vs.	Truth
"The idea must be unique"	→	NOT TRUE! Even common idea works differently

Example: inDrive allowed fare negotiation

Myth		Truth
"You need lots of money to start a business"	→	Some start with small capital

Example: Bittoo Tikki Wala began on the street

Myth		Truth
"Only big businesses count"	→	NOT TRUE. Even a small business owner is an entrepreneur
	→	

Myth		Truth
"Entrepreneurs are born, not made"	→	WRONG! Can be learned and developed with practice/training

ENTREPRENEURSHIP AS A CAREER OPTION

STEPS IN THE ENTREPRENEURIAL JOURNEY

SHOP

ENTRY STAGE Starts the business

SURVIVAL STAGE Competing in market to stay

GROWTH STAGE Expanding after becoming stable

WHY CHOOSE ENTREPRENEURSHIP? (ADVANTAGES)

Freedom Your own boss

Satisfaction Follow dreams

Wealth Help economy grow, earn profits

Work-Life Decide own schedule

CHALLENGES IN ENTREPRENEURSHIP (DISADVANTAGES)

Risk Use own money and time

Workload A lot of effort to start/run

Difficulties Stress, late nights, of funding

Uncertainty Market, laws, needs change

GREEN SKILLS & SUSTAINABILITY

What are Green Skills?
Green Skills are the knowledge, values, abilities, and attitudes needed to protect the environment and use natural resources wisely. These skills help people live and work in a sustainable way.

Green skills are important for:
- Protecting nature
- Reducing pollution
- Saving energy and water
- Creating a cleaner and healthier future

Definition
"Green skills are the skills that help individuals support environmental protection and sustainable development."

Importance of Green Skills
Green skills are necessary because:

- Climate change is increasing rapidly.
- Natural resources are getting depleted.
- Pollution is harming humans and animals.
- Future jobs require eco-friendly practices.

Benefits of Green Skills
✔ Protect environment
✔ Reduce waste and pollution
✔ Save energy and resources
✔ Improve health and quality of life
✔ Create green jobs and careers
✔ Build a sustainable future

Examples of Green Skills

Green Skills	Meaning
Energy Conservation	Saving electricity and fuel
Water Conservation	Using water carefully
Waste Management	Proper disposal and recycling of waste
Recycling	Reusing materials like paper, plastic, and glass
Sustainable Transport	Using bicycles, public transport, EVs
Tree Plantation	Increasing green cover
Green Technology	Eco-friendly technologies
Green Jobs and Careers	Many new jobs are developing in the green sector.

Career Opportunities
- Environmental Scientist
- Renewable Energy Technician
- Sustainability Analyst
- Climate Change Researcher
- Waste Management Expert
- Green Architect

Ways to Develop Green Skills

- Learn about environmental issues.
- Practice eco-friendly habits daily.
- Participate in awareness programs.
- Reduce, Reuse, and Recycle (3Rs).
- Save electricity and water.
- Join eco-clubs and green campaigns.

SUSTAINABILITY & SUSTAINABLE DEVELOPMENT

What is Sustainability?
Sustainability means:
"Meeting our present needs without harming the ability of future generations to meet their needs."

It focuses on balancing:

- Environment
- Economy
- Society

Three Pillars of Sustainability

Pillar	Meaning
Environmental Sustainability	Protecting nature and resources
Social Sustainability	Equality, health, education, justice
Economic Sustainability	Responsible economic growth

What is Sustainable Development?
Sustainable Development means development that:

- Improves quality of life
- Protects the environment
- Uses resources wisely
- Supports future generations

Main Goals

✔ Reduce pollution
✔ Save natural resources
✔ Promote clean energy
✔ Ensure equality and peace
✔ Build healthy communities

Sustainable Development Goals (SDGs)
The United Nations introduced 17 Sustainable Development Goals (SDGs) to achieve a better world by 2030.

The 17 SDGs

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth

9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals

OUR ROLES AND CONTRIBUTIONS

Role of Students in Sustainability

Students can contribute greatly towards environmental protection.

What Students Can Do

At Home

✔ Switch off lights and fans when not in use
✔ Save water
✔ Avoid food wastage
✔ Use cloth bags instead of plastic bags

At School

✔ Keep classrooms clean
✔ Participate in eco-club activities
✔ Plant trees
✔ Spread awareness among friends

In Society

✔ Participate in cleanliness drives
✔ Promote recycling
✔ Encourage use of public transport
✔ Support green initiatives

Reduce, Reuse and Recycle (3Rs)

- **Reduce**
  Use fewer resources and avoid wastage.
- **Reuse**
  Use items again instead of throwing them away.
- **Recycle**
  Convert waste into useful products.

Example

Recycle paper and plastic
Reuse bottles and containers
Reduce electricity usage

Importance of Individual Contribution

Every small action matters.
Small Actions Can:

- Reduce pollution
- Save natural resources
- Protect biodiversity
- Reduce global warming
- Build a cleaner future

Quick Revision Points

✔ Green skills help protect the environment.
✔ Sustainability means caring for present and future generations.
✔ Sustainable development balances environment, society, and economy.
✔ SDGs are 17 global goals for a better future.
✔ SDG 17 promotes partnerships and teamwork.
✔ Students play an important role in environmental protection.
✔ Follow the 3Rs: Reduce, Reuse, Recycle.

MULTIPLE CHOICE QUESTIONS

Q1. A school installed solar panels and replaced normal bulbs with LED lights to reduce electricity consumption. Which type of energy is used by solar panels?
A. Thermal Energy C. Nuclear Energy
B. Renewable Energy D. Fossil Fuel Energy

Q2. What is the main purpose of using LED bulbs?
A. Increase pollution C. Save energy
B. Waste electricity D. Produce heat

Q3. Kitchen waste is mainly:
A. Non-biodegradable C. Biodegradable waste
B. Hazardous waste D. E-waste

Q4. Separating waste before disposal helps in:
A. Increasing pollution B. Proper recycling
C. Water wastage D. Soil erosion

Q5. Old computers and mobile phones are examples of:
A. Organic waste B. E-waste
C. Renewable resources D. Biomass

Q6. Improper disposal of e-waste may cause:
A. Better soil quality B. Reduced pollution
C. Environmental pollution D. Increase in forests

Q7. A village introduced rainwater harvesting systems to store rainwater for future use. Rainwater harvesting helps in:
A. Water conservation B. Air pollution
C. Deforestation D. Soil pollution

Q8. Water is classified as:
A. Non-renewable resource
B. Renewable resource
C. Fossil fuel
D. Hazardous material

Q9.Students organized a campaign encouraging people to use cloth bags instead of plastic bags. Using cloth bags mainly supports:
A. Increase in plastic waste
B. Sustainable living
C. Soil erosion
D. Deforestation

Q10. Choose the option which is NOT a Sustainable Development Goal according to United Nations (CBSE 2026)
A. Population B. No Poverty
C. Quality Education D. Reduced Inequalities

Q11. Assertion (A):Sustainable development helps protect natural resources for future generations.
Reason (R): Sustainable development promotes the careful and balanced use of environmental, social, and economic resources.
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.

Q12. Assertion (A): Using reusable bags and bottles is an example of practicing green skills.
Reason (R): Green skills encourage reducing waste and protecting the environment through eco-friendly habits.
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.

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
B	C	C	B	B	C	A	B	B	A	A	A

SHORT ANSWER QUESTIONS (1 MARK / 2 MARKS)

Q1. Why are green skills considered important for future careers?

Green skills are important because many future jobs will focus on environmental protection and sustainable practices.

Q2. A student keeps electronic devices switched on unnecessarily. Which green skill is missing here?

Energy conservation.

Q3. How does recycling help in sustainability?

Recycling reduces waste and saves natural resources, helping protect the environment.

Q4.Why is public transport considered environmentally friendly?

Public transport reduces fuel consumption and air pollution.

Q5. How can small individual actions support SDG 13 (Climate Action)?

Actions like saving electricity and planting trees help reduce environmental damage and support climate action.

Q6. Your school wants to reduce plastic waste. Suggest any two green practices students can follow.

a) Students can reduce plastic waste by using reusable water bottles, steel lunch boxes, and cloth bags instead of single-use plastics.
b) They can also avoid plastic wrappers and participate in recycling drives organized by the school.

These practices help reduce pollution and protect the environment.

Q7. Explain how sustainable development balances present and future needs.

Sustainable development uses resources carefully to meet present needs while ensuring enough resources remain for future generations. Sustainable development focuses on meeting the needs of people today without damaging natural resources needed by future generations.

It encourages careful use of water, energy, forests, and other resources so that both present and future generations can live a healthy and secure life

Q8. A community faces water shortage due to wastage. Suggest two sustainable solutions.

a) Repair leaking pipes and taps to prevent water loss.
b) Practice rainwater harvesting and controlled water usage.

Q9. How does SDG 17 help in achieving other Sustainable Development Goals?

SDG 17 promotes partnerships and cooperation among countries and organizations, making it easier to share knowledge, technology, and resources to solve environmental and social problems more effectively and achieve all the Sustainable Development Goals.

Q10. Explain how students can become responsible citizens through green skills.

Students can develop responsible habits like conserving resources, reducing waste, participating in eco-friendly activities, and spreading environmental awareness.

Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz Link : https://forms.gle/rJxMFTF3FXiVsWPy6

Green Skills

1. WHAT IS SUSTAINABLE DEVELOPMENT?

Meeting present needs without compromising future generations

Balance between growth, environment, and society

2. MAIN AREAS OF SUSTAINABLE DEVELOPMENT

1. ECONOMIC GROWTH
2. ENVIRONMENTAL PROTECTION
3. SOCIAL WELL-BEING

3. IMPORTANCE OF SUSTAINABLE DEVELOPMENT

- Saves natural resources
- Reduces pollution
- Protects environment
- Supports future generations

4. CHALLENGES TO SUSTAINABILITY

Food problems due to chemical use

Water shortage, pollution, and energy crisis

5. WAYS TO PROMOTE SUSTAINABILITY

Use resources wisely | Recycle and reuse waste | Plant more trees | Use renewable energy

Protect ecosystems | Support eco-friendly farming | Promote sustainable consumption

6. SUSTAINABLE DEVELOPMENT GOALS (SDGs)

- Goal 1: No Poverty
- Goal 2: Zero Hunger
- Goal 3: Good Health and Well-being
- Goal 4: Quality Education
- Goal 5: Gender Equality
- Goal 6: Clean Water and Sanitation
- Goal 7: Affordable and Clean Energy
- Goal 8: Decent Work and Economic Growth
- Goal 9: Industry, Innovation and Infrastructure
- Goal 10: Reduced Inequalities
- Goal 11: Sustainable Cities and Communities
- Goal 12: Responsible Consumption and Production
- Goal 13: Climate Action
- Goal 14: Life Below Water
- Goal 15: Life on Land
- Goal 16: Peace, Justice and Strong Institutions
- Goal 17: Partnerships for the Goals

7. WHY SHOULD WE CARE?

Population growth increases resource demand | Pollution damages nature | Deforestation and plastic waste are major threats | Future generations depend on our actions

8. HUMAN ACTIVITIES HARMING NATURE

Air pollution | Water pollution | Deforestation | Plastic waste in oceans

9. INDIVIDUAL CONTRIBUTIONS

- Save water and electricity
- Use renewable energy
- Buy eco-friendly products
- Reduce waste
- Use public transport / cycles
- Participate in tree planting

10. COMMUNITY & NATIONAL EFFORTS

Promote recycling | Proper waste disposal | Awareness campaigns | Use biodegradable materials

Solar energy projects

11. INDIAN SUSTAINABILITY INITIATIVES

Charanka Solar Park

Clay kulhads in railways

Edible cutlery & spoons

Biodegradable plastic bags

PART – B: SUBJECT SPECIFIC SKILLS

UNIT I: REVISITING AI PROJECT CYCLE & ETHICAL FRAMEWORKS FOR AI

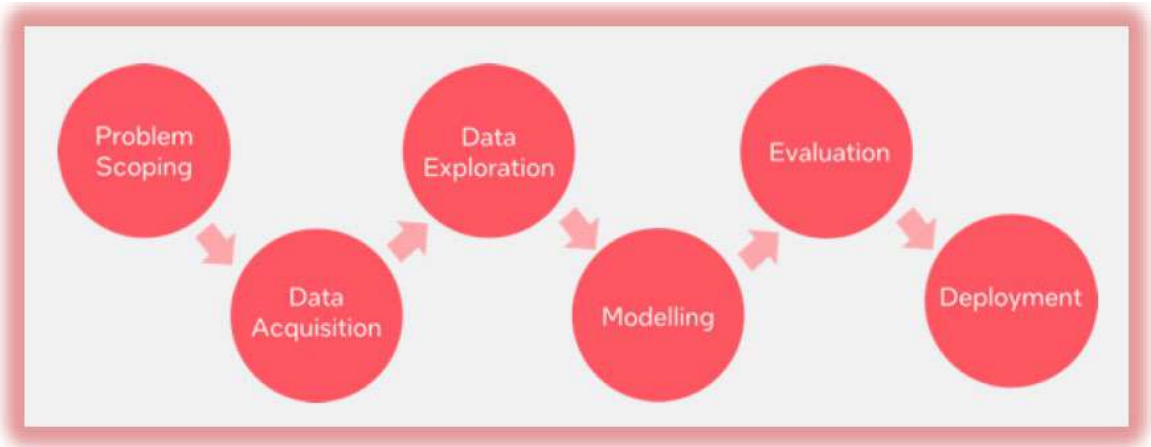
What is an AI Project Cycle?

Project Cycle is a step-by-step process to solve problems using proven scientific methods and drawing inferences about them.

Components of the project cycle are the steps that contribute to completing the Project.

The Components of AI Project Cycle are:

1. **Problem Scoping** - Understanding the problem
2. **Data Acquisition** - Collecting accurate and reliable data
3. **Data Exploration** - Arranging the data uniformly
4. **Modelling** - Creating Models from the data
5. **Evaluation** - Evaluating the project
6. **Deployment** - It's where the solution transitions from development to real-world application



Starting with Problem Scoping, you set the goal for your AI project by stating the problem which you wish to solve with it. Under problem scoping, we look at various parameters which affect the problem we wish to solve so that the picture becomes clearer.

To proceed,

● You need to acquire data which will become the base of your project as it will help you understand what the parameters that are related to problem scoping are.

● You go for data acquisition by collecting data from various reliable and authentic sources. Since the data you collect would be in large quantities, you can try to give it a visual image of different

types of representations like graphs, databases, flow charts, maps, etc. This makes it easier for you to interpret the patterns which your acquired data follows.

● After exploring the patterns, you can decide upon the type of model you would build to achieve the goal. For this, you can research online and select various models which give a suitable output.

● You can test the selected models and figure out which is the most efficient one.

● The most efficient model is now the base of your AI project and you can develop your algorithm around it.

● Once the modeling is complete, you now need to test your model on some newly fetched data. The results will help you in evaluating your model and improving it.

● Finally, after evaluation, the deployment stage is crucial for ensuring the successful integration and operation of AI solutions in real-world environments, enabling them to deliver value and impact to users and stakeholders.

With respect to the type of data fed in the AI model, AI models can be broadly categorized into **three domains**

1. **Statistical Data**: Statistical Data is a domain of AI related to data systems and processes, in which the system collects numerous data, maintains data sets and derives meaning/sense out of them.

   Application: Price Comparison Websites

2. **Computer vision**: abbreviated as CV, is a domain of AI that depicts the capability of a machine to get and analyze visual information and afterwards predict some decisions about it. The entire process involves image acquiring, screening, analyzing, identifying and extracting information.

   Applications
   - Agricultural Monitoring
   - Surveillance Systems

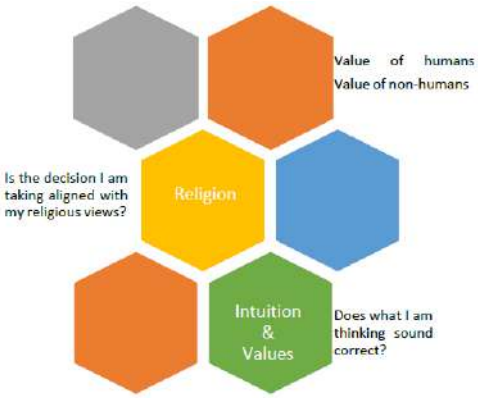
3. **Natural Language Processing**: Natural Language Processing, abbreviated as NLP, is a branch of artificial intelligence that deals with the interaction between computers and humans using the natural language.

   Applications

   - Email filters
   - Machine Translation

Ethical Frameworks for AI

- **Frameworks** are a set of steps that help us in solving problems. It provides a step-by-step guide for solving problems in an organized manner
- **Ethics** are a set of values or morals which help us separate right from wrong. Frameworks are **step-by-step** guidance on solving problems.
- **Ethical frameworks** are frameworks which help us ensure that the choices we make do not cause unintended harm.
- **Why do we need?** Ethical frameworks ensure that AI makes morally acceptable choices. If we use ethical frameworks while building our AI solutions, we can avoid unintended outcomes, even before they take place!



Ethical frameworks for AI can be categorized into two main types:

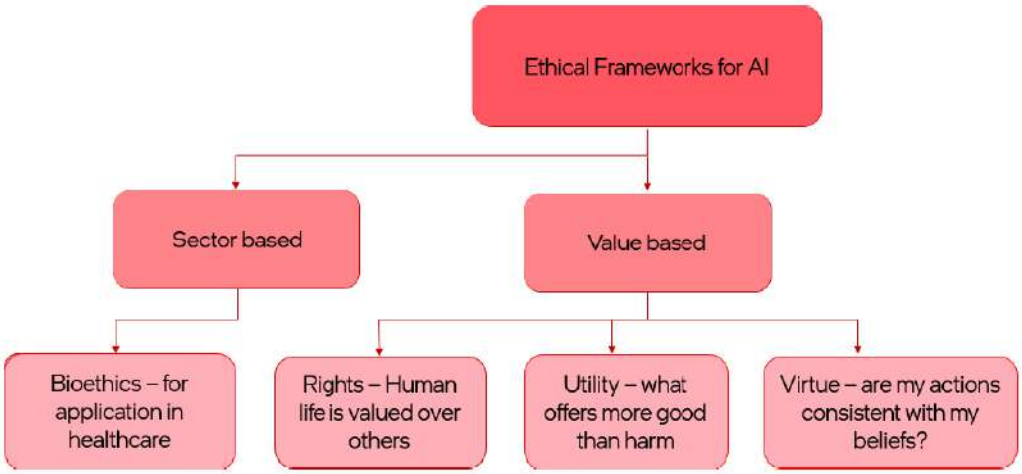
1. **Sector-based:** These are frameworks tailored to specific sectors or industries. In the context of AI, one common sector-based framework is Bioethics, which focuses on ethical considerations in healthcare.
2. **Value based frameworks**: Value-based frameworks focus on fundamental ethical principles and values guiding decision making. It reflects the different moral philosophies that inform ethical reasoning

They can be further classified into **three categories**

i. **Rights-based**: Prioritizes the protection of human rights and dignity, valuing human life over other considerations

ii. **Utility-based:** Evaluates actions based on the principle of maximizing utility or overall good, aiming to achieve outcomes that offer the greatest benefit and minimize harm.

iii. **Virtue-based:** This framework focuses on the character and intentions of the individuals involved in decision-making.



Bioethics is an ethical framework used in healthcare and life sciences. It deals with ethical issues related to health, medicine, and biological sciences, ensuring that AI applications in healthcare adhere to ethical standards and considerations.

Principles of bioethics:

- Respect for Autonomy.
- Do not harm.
- Ensure maximum benefit for all.
- Give justice.
- "**Non-maleficence**" refers to the ethical principle of avoiding causing harm or negative consequences
- "**Maleficence**" refers to the concept of intentionally causing harm or wrongdoing.
- "**Beneficence**" refers to the ethical principle of promoting and maximizing the well-being and welfare of individuals and society.

The ***four principles*** of bioethics can be used to ensure an ethical AI solution for the *healthcare problem*

i. **Respect for autonomy**: Enabling users to be fully aware of decision-making. E.g., users of an AI algorithm should know how it functions.

ii. **Do not harm**: Harm to anyone (be it human or non–human) must be avoided at all costs

iii. **Maximum benefit**: Not only should we avoid harm our actions must focus on providing the maximum benefit possible

iv. **Justice:** All benefits and burdens of a particular choice must be distributed in a justified manner across people irrespective of their background.

MUTIPLE CHOICE QUESTIONS

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. Which stage of the Al Project Cycle involves testing the model on newly fetched data? [CBSE 2026(1st Exam)]

a) Data Exploration
b) Modelling
c) Evaluation
d) Deployment

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. What do frameworks provide in the context of problem-solving?

a) Random solutions
b) Step-by-step guidance
c) Legal advice
d) Ethical justifications

Q7. Ethical frameworks are primarily designed to: [CBSE 2026(1st Exam)]

a) Increase the efficiency of Al algorithms.
b) Ensure that choices made do not cause unintended harm.
c) Reduce the cost of Al development.
d) Speed up the Al project cycle.

Q8. 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

Q9. 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

Q10. Assertion (A): Bioethics is an example of a Value-based Framework for AI.

Reason (R): Bioethics deals with ethical issues related to health, medicine, and biological sciences. [CBSE 2026(1st Exam)]

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.

Q11. **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.

Q12. **Assertion**: Value-based frameworks in ethics provide guidance by focusing on fundamental ethical principles and values.

Reasoning: These frameworks reflect different moral philosophies guiding ethical reasoning and are concerned with assessing the moral worth of actions.

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.

Q13.You would feed the data into the machine. This is the data with which the machine can be trained. Now, once it is ready, it will predict his next data efficiently. This previous data is known as _.

a) Testing Data b) Training Data
b) Exploring Data d) All of the above

Q 14.How you can identify the problem scoping in the project.

a) Understand why the project was started
b) Define the project's primary objectives
c) Outline the project's work statement.
d) All of the above

Q15.For better efficiency of an AI project Training data should be _____

i) Relevant ii) Scattered
iii) Structured iv) Authentic

Choose the correct option:

a) Both i and ii b) Both i and iv
c) Only I d) Only iv

Q16. Which one of the following is the second stage of AI project cycle?

a) Data Exploration
b) Data Acquisition
c) Modelling
d) Problem Scoping

Q17. Which of the following comes under Problem Scoping?

a) System Mapping
b) 4Ws Canvas
c) Data Features
d) Web scraping

Q18. The primary purpose of data exploration in AI project cycle is

a) To make data more complicated
b) To simplify complex data
c) To discover patterns and insights in data
d) To visualize data

Q19. How you can identify the problem scoping in the project.

a) Understand why the project was started
b) Define the project's primary objectives
c) Outline the project's work statement.
d) All of the above

Q20._____ summarizes all of the important points in one place.

a) Problem statement template
b) Problem statement document
c) Problem statement files
d) None of the above

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
b	c	b	c	c	b	b	c	a	d
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
a	a	b	d	b	b	b	c	d	a

SHORT ANSWER TYPE QUESTIONS(1 MARK / 2 MARKS)

Q1. What is the major role of an AI Project Cycle?
Answer
The major role of AI Project Cycle is to distribute the development of AI project in various stages so that the development becomes easier, clearly understandable and the steps / stages should become more specific to efficiently get the best possible output.

Q2. What roles does computer vision play in agricultural monitoring systems?
Answer
Computer vision is employed in agriculture for crop monitoring, pest detection, and yield estimation. Drones with cameras capture aerial images of farmland, which are then analysed to assess crop health and optimize farming practices.

Q3. Mention the factors which knowingly or unknowingly influence our decision-making.
Answer

- Value of humans Value of non-humans
- Religion: Is the decision I am taking aligned with my religious views?
- Intuition &Values: Does what I am thinking sound correct?
- Identity of the charity recipient.
- Location of the recipient.
- Bias towards relatives.
- Uncovering information available.

Q4. What is the necessity for Ethical Frameworks in AI development?
Answer
Ethical frameworks in AI development are necessary to ensure that AI is safe, fair, trustworthy, accountable, and aligned with human values. They act as guardrails in an evolving landscape, helping developers, companies, and governments steer AI toward socially beneficial outcomes. Ethical frameworks ensure that AI makes morally acceptable choices. If we use ethical frameworks while building our AI solutions, we can avoid unintended outcomes, even before they take place!

Q5. Mention the key characteristics of sector-based frameworks.
Answer

Sector-based AI frameworks are customized, practical, and context-aware guidelines that bridge general ethical principles and real-world application. They help ensure AI systems are safe, fair, and effective within their specific domains of use.

It addresses issues such as patient privacy, data security, and the ethical use of AI in medical decision-making.

Q6. What do you mean by Bioethics?

Answer
Bioethics is an ethical framework used in healthcare and life sciences. It deals with ethical issues related to health, medicine, and biological sciences, ensuring that AI applications in healthcare adhere to ethical standards and considerations. Bioethics helps society navigate complex ethical challenges in medicine and life sciences by promoting responsible and humane practices in the face of technological and scientific progress.

Q7. What are three categories of Value-based Frameworks?

Answer

i. **Rights-based**: Prioritizes the protection of human rights and dignity, valuing human life over other considerations

ii. **Utility-based:** Evaluates actions based on the principle of maximizing utility or overall good, aiming to achieve outcomes that offer the greatest benefit and minimize harm.

iii. **Virtue-based:** This framework focuses on the character and intentions of the individuals involved in decision-making.

Q8. How do value-based frameworks contribute to ethical decision-making by emphasizing fundamental principles and values?

Answer
Value-based frameworks center around core moral values such as:

- Autonomy – Respecting individuals' rights to make informed choices
- Justice – Ensuring fairness, equality, and non-discrimination
- Beneficence – Promoting well-being and positive outcomes
- Non-maleficence – Avoiding harm
- Accountability – Taking responsibility for decisions and outcomes
- Transparency – Making AI processes understandable and traceable

Value-based frameworks contribute to ethical AI decision-making by:

- Embedding core moral values into design and policy
- Offering a principled approach for navigating complex choices
- Supporting human-centric, fair, and responsible AI development
- They ensure that AI does not just function correctly—but does the right thing.

Q9. What are Fundamental Principles of Ethical Frameworks?

Answer

- **Fairness:** Avoiding bias and ensuring equitable treatment
- **Transparency**: Making AI systems understandable and explainable
- **Accountability**: Ensuring someone is responsible for AI outcomes
- **Privacy and Data Protection**
- **Human-Centeredness:** Keeping human welfare and autonomy at the core
- **Safety and Security:** Preventing unintended harm

Q10. How Natural Language Processing is using in Machine Translation?

Answer

NLP is used in machine translation systems like Google Translate and Microsoft Translator to automatically translate text from one language to another. These systems analyze the structure and semantics of sentences in the source language and generate equivalent translations in the target language

Q.11 Explain the difference between sector-based and value-based ethical frameworks.

[CBSE 2026]

Answer

Sector-based ethical frameworks (Any one):

- These are frameworks tailored to specific sectors or industries.
- Different sectors face different ethical challenges.
- Sector-based ethical frameworks may also apply to domains such as finance, education, transportation, agriculture, governance, and law enforcement.

Example: Bioethics focuses on ethical considerations in healthcare. Patient privacy, data security.

Value-based ethical frameworks (Any one):

- Value-based frameworks focus on fundamental ethical principles and values guiding decision making.
- It reflects the different moral philosophies that inform ethical reasoning.
- Value-based frameworks are concerned with assessing the moral worth of actions and guiding ethical behaviour.

Examples: Rights-based framework (valuing human life over other considerations), Virtue-Based/Whether developing good ethical values), Utility-Based (maximize overall good).

LONG ANSWER QUESTIONS (4 MARKS)

Q1. A global company deploys an AI system to automate its recruitment process. The system is trained on historical hiring data to screen and rank job applicants. After several months, internal audits reveal that the AI consistently ranks male applicants higher than equally qualified female and minority candidates.

The HR team is now under pressure to either fix the bias or shut down the system. The company wants to use an ethical framework to guide its next steps

Using an ethical AI framework, how should the company evaluate and respond to the bias in its AI recruitment system? Identify the ethical principles involved and propose a suitable course of action

Answer

a. Human Agency and Oversight

Issue: Automated decisions are made without sufficient human review.

Action: Reintroduce human oversight in final hiring decisions, especially for flagged or borderline candidates.

b. Technical Robustness and Safety

Issue: The model lacks fairness and accuracy across demographics.

Action: Audit and retrain the AI with diverse, balanced, and inclusive data, and test for bias using fairness metrics.

c. Privacy and Data Governance

Issue: Personal applicant data is used for algorithmic profiling.

Action: Ensure transparent data use policies and compliance with privacy laws (e.g., GDPR).

d. Transparency

Issue: Candidates and even HR staff are unclear on how decisions are made.

Action: Use explainable AI tools to show how and why the model ranks candidates.

Q2. Akhil wants to learn how to scope the problem for an AI Project. Explain him the following:

(a) 4W Problem Canvas

(b) Problem Statement Template

Answer

The 4Ws Problem canvas helps in identifying the key elements related to the problem. The 4Ws are Who, What, Where and Why

- The "Who" block helps in analysing the people getting affected directly or indirectly due to the problem.
- The "What" block helps us to determine the nature of the problem.

- The “Where” block helps us to look into the situation in which the problem arises, the context of it, and the locations where it is prominent.
- The “Why” block suggests to us the benefits which the stakeholders would get from the solution and how it will benefit them as well as the society

Our	[stakeholders]	Who
Have a problem that	[need]	What
When/while	[context/ location/ situation]	Where
An ideal solution would be	[solution]	Why

Q3. A city government wants to implement a computer vision-based traffic monitoring system to detect traffic violations like running red lights and illegal parking. The system uses real-time video feeds and AI to automatically identify license plates and send violation notices.

What are the key ethical considerations for successfully deploying this computer vision application, and how can these challenges is addressed?

Answer

1. Privacy and Surveillance Concerns
Issue: Constant monitoring may violate citizens’ privacy.
Solution: Anonymize individuals in video feeds and encrypt license plate data, limiting access only to authorized personnel.

2. Data Retention and Use
Issue: Misuse or over-retention of surveillance data.
Solution: Set clear data retention policies and delete data once its intended purpose is fulfilled, unless legally required otherwise.

3. Bias and Fairness

Issue: Algorithmic bias may disproportionately flag vehicles in certain areas or with certain license styles.

Solution: Audit training data for representativeness and ensure fair distribution of detection accuracy across demographics and vehicle types.

4. Transparency and Accountability
Issue: Citizens may not understand how or why they were flagged.

Solution: Provide public documentation of how the system works and establish a dispute resolution process for incorrect fines.

Q4. A customer service company wants to implement an NLP-based chatbot to handle client inquiries 24/7. The goal is to reduce human workload, improve response time, and increase customer satisfaction. However, users speak different languages, use slang, and sometimes express frustration or sarcasm.

Answer

1. **Transparency**

Issue: Customers may feel misled if they think they're talking to a human.
Solution: Clearly disclose at the beginning that they are interacting with an AI system.

2. **Bias and Fairness**

Issue: The bot may reflect biased training data and respond inappropriately to certain user groups.
Solution: Audit and test the system using diverse inputs to minimize bias, and use inclusive training datasets that represent different cultures, accents, and language use.

3. **Data Privacy**

Issue: The bot handles sensitive customer information.
Solution: Encrypt conversations, comply with data privacy laws (e.g., GDPR, CCPA), and limit data retention to what's necessary.

4. **User Trust and Experience**

Issue: Poor or robotic responses may frustrate users.
Solution: Train the bot to use natural, empathetic language and gather feedback through surveys to continuously improve interaction quality.
To successfully implement an NLP-based customer service chatbot, the company should:

- Use robust multilingual and sentiment-aware NLP models
- Ensure ethical practices, including transparency, fairness, and data protection
- Design with the user experience in mind, allowing seamless escalation and empathetic dialogue

Q5. A hospital implements an AI diagnostic tool that analyzes medical images (e.g., X-rays, MRIs) to assist doctors in detecting diseases like cancer. The AI has shown high accuracy in clinical trials, but a recent case revealed that it missed a rare condition, leading to a delayed diagnosis and patient harm.
Using bioethical principles (autonomy, beneficence, non-maleficence, and justice), evaluate the ethical implications of deploying such AI systems in clinical settings. What measures should be taken to ensure that AI in healthcare aligns with bioethical standards?

Answer

Bioethical Principles Applied:

1. Autonomy

Issue: Patients may not be informed that AI is involved in their diagnosis.

Action: Ensure informed consent, where patients are made aware of AI usage and have the right to ask for human-only analysis.

2. Beneficence (Do Good)

Issue: AI is intended to enhance diagnosis and reduce errors.

Action: Continuously improve the model's performance and ensure it's used to support, not replace, clinicians.

3. Non-Maleficence (Do No Harm)

Issue: A missed diagnosis caused real patient harm.

Action: Set clear protocols for human oversight; use AI only as a second opinion, not the sole source of decision-making.

4. Justice

Issue: AI might perform poorly for certain demographics (e.g., rare conditions, underrepresented groups).

Action: Audit the model for bias and equity, and expand training data to include diverse patient populations.

Recommended Measures:

- Implement explain ability tools so doctors can understand AI decisions.
- Require dual validation—AI + physician—before acting on diagnoses.
- Set up ethics review boards to evaluate AI tools before deployment.
- Create a feedback loop to learn from errors and update the system regularly.
- Provide transparency reports to patients and regulators about AI limitations.

This scenario underscores the importance of bioethics in AI applications for healthcare. While AI offers enormous potential, adherence to the principles of autonomy, beneficence, non-maleficence, and justice is essential to ensure safe, ethical, and equitable patient care.

Practical Session on Frameworks, Ethical Framework and need of Ethical Frameworks for AI. Activity: My Goodness https://www.my-goodness.net/

Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz Link : https://forms.gle/8AwmcZK9ZvVRaP929

Revisiting AI Project Cycle & Ethical Frameworks for AI

Scoping, Acquisition, and Exploration

Define the problem goal, gather reliable data, and visualize patterns to interpret information.

Modeling and Algorithm Selection

Research and select the most efficient algorithm, then test it against new data.

Testing and Evaluation

Test the solution against new data.

AI Domains & Applications

Domain		Application Example
Statistical Data		Price Comparison Websites
Computer Vision (CV)		Agricultural Monitoring & Surveillance
Natural Language (NLP)		Email Filters & Machine Translation

Ethical Frameworks & Bioethics

Sector vs. Value-Based Frameworks

Sector Frameworks (e.g., Bioethics)
Target specific industries.

Value Frameworks
Focus on rights and utility.

The Four Bioethics Principles

Autonomy (awareness)
Respect for individual decision-making.

Non-maleficence (do no harm)
Avoid causing harm.

Beneficence (maximum benefit)
Act in the best interest of others.

Justice (fair distribution)
Fairness and equality in distribution.

Value Frameworks

Mitigating Bias in Data

Skewed Metrics

Spending Data (Skewed)

AI output

Actual Conditions

Illness Data (Reflects Reality)

Ensure training data reflects actual conditions rather than skewed metrics.

NotebookLM

UNIT-2: ADVANCED CONCEPTS OF MODELING IN AI

Introduction to AI, ML, and DL

Artificial Intelligence (AI): When machines behave like humans and make smart decisions.
Example: A robot that can chat with you.

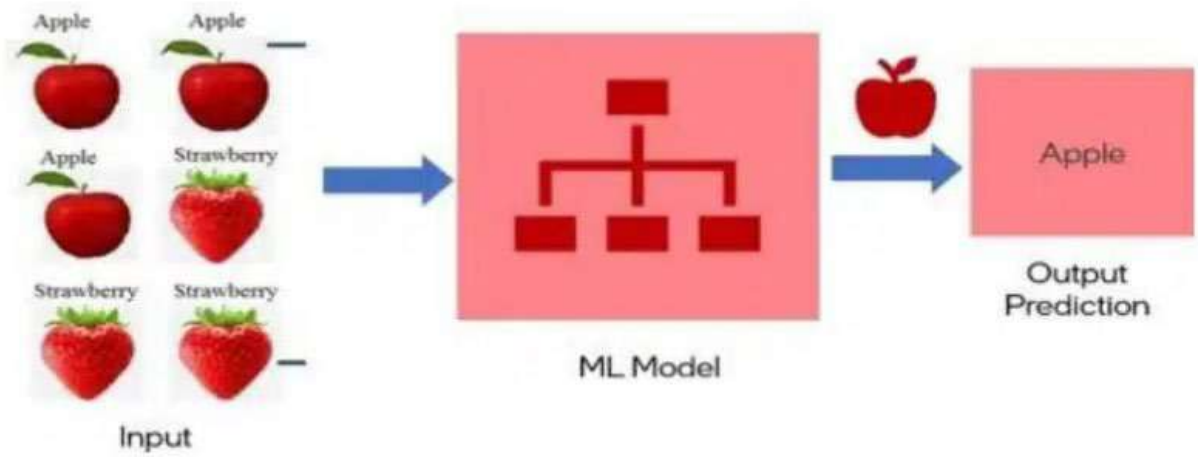
Machine Learning (ML): When machines learn from data and improve automatically.
Example: A movie app that suggests your favorite type of films.

Deep Learning (DL): A part of ML where machines learn deeply using lots of data and complex networks.

Example: Your phone recognizing your face to unlock.

Machine Learning

ML : Learning from Data

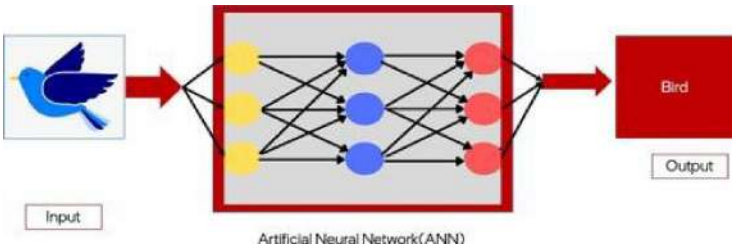


- Input = Past data (like pictures of fruits)
- Output = Predictions (like identifying a fruit as an apple or a Strawberry)
- ML improves itself over time using experience.

Examples of ML:

- **Object Classification**: Spotting a dog or cat in an image.
- **Anomaly Detection**: Finding something odd, like an unusual heartbeat in health data.

Deep Learning (DL)



- A special kind of ML.
- Uses neural networks to understand complex things.
- Learns from huge datasets (like thousands of images).

Examples:

- You show a bird photo.
- The DL model sees pixel by pixel and says, "That's a bird!"
- Used in face recognition, voice assistants, language translation.

Common Terms Used

Data: Raw information

Label Feature

Fruit	Color	Price
Apple	Red	$1.8
Orange	Orange	$2
Banana	Yellow	$1
Grape	Purple	$3

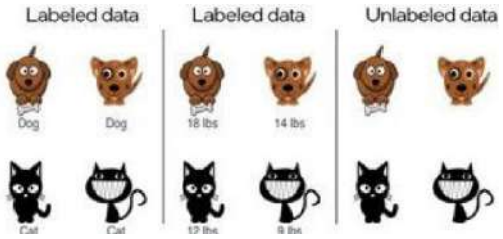
Features:

- Columns of the tables are called features
- Details about data (color, size, price).

Labels:

- Data Labelling is the process of attaching meaning to data
- What you're trying to predict (fruit name).

Types of Data



Labelled Data

- Data to which a tag/label is attached.
- For example: Name, type, number, etc.

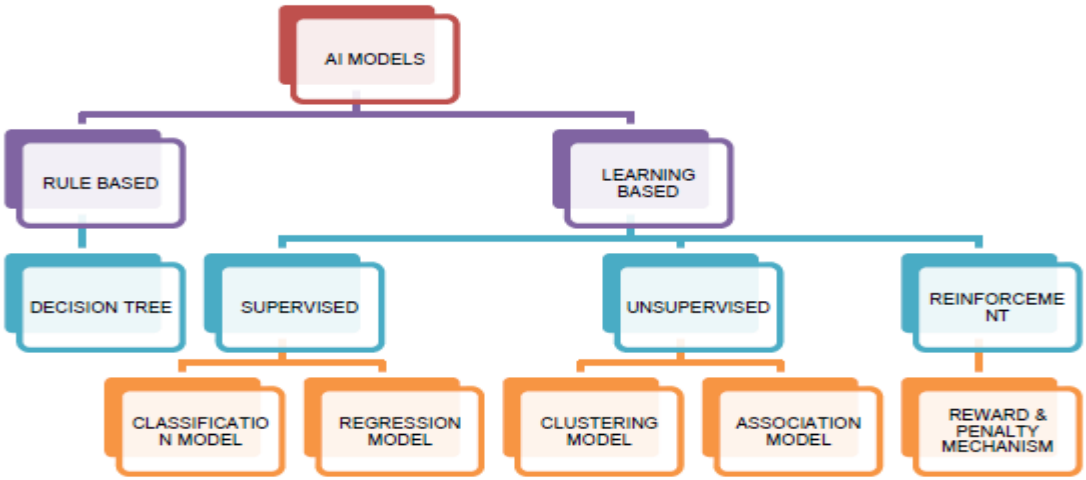
Unlabelled Data

- The raw form of data
- Data to which no tag is attached

Training Data vs Testing Data

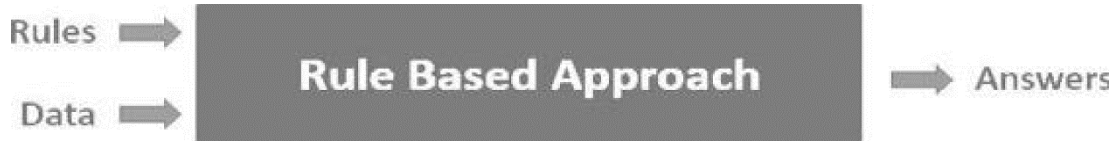
Training Data	Testing Data
The training dataset is a collection of samples given to the model to analyse and learn.	The testing dataset is a collection of samples given to the model to test its accuracy.
A set of labelled data is used to train the AI model	The test is performed without labelled data and then verify results with labels.

Two Types of AI Models



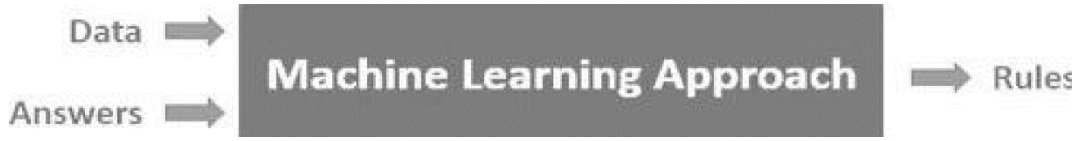
1. Rule-Based AI

- Follows fixed instructions.
- No learning or improvement.
- Example: A simple chatbot that answers FAQs with fixed replies.



2. Learning-Based AI

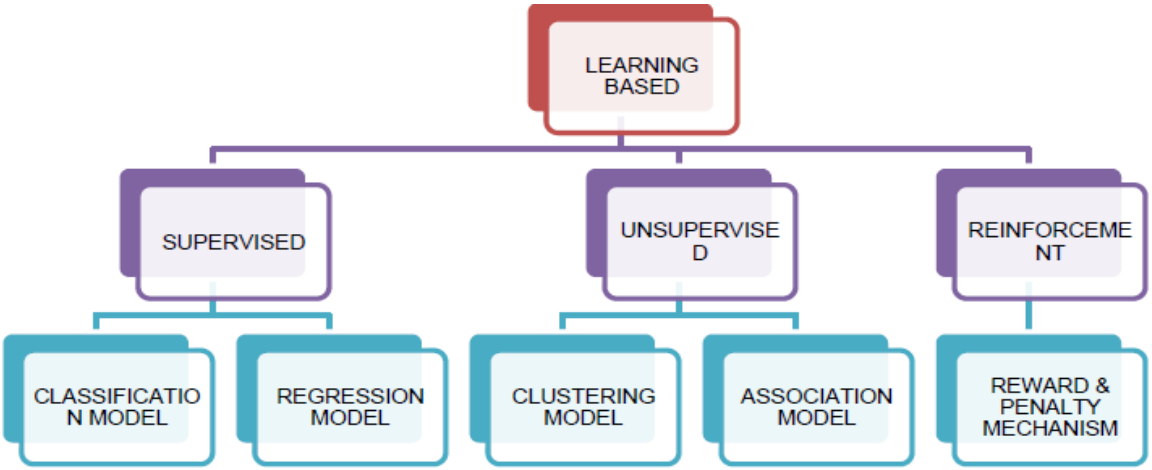
- Learns from data.
- Can adapt and improve.
- Example: A spam filter that gets better over time.



Note: Rule-based AI makes Fixed models (cannot adapt to changes),

Learning-based AI makes Flexible models (can adapt to changes)

Types of Learning Models



A. Supervised Learning

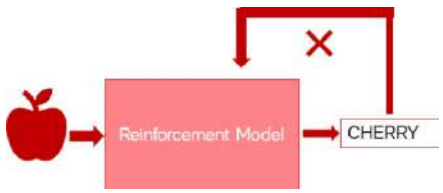
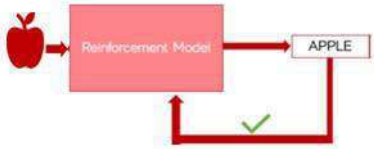
Labelled data used for training.
Machine learns from examples and makes predictions.
Example:
You show a coin and its weight.
The model learns: 5g = Euro, 3g = Dollar.
Later, it guesses the coin based on weight.

B. Unsupervised Learning

Unlabelled data is used for training
No labels.
Machine finds patterns or groups.
Example:
1000 photos of dogs with no info.
The model groups them by size or color.

C. Reinforcement Learning

Learn by Rewards
The machine tries something.
Gets a reward for right actions, a penalty for wrong ones.

Penalty	Reward
	

Example:

You show a fruit.

Model says cherry → wrong → gets negative point.

Tries again → says apple → right → gets reward.

Used in self-driving cars, games, and robotics.

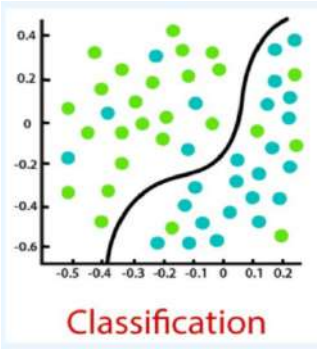
Differences between Supervised and Unsupervised Learning

Supervised Learning	Unsupervised Learning
Learns from labelled data.	Learns from unlabelled data.
Easy to train and use.	Finds hidden patterns.
Need less computing power	Need more computing power

Sub-categories of Supervised Learning Model

A. Classification

- Predicts **categories**.
- Output is discrete (like YES or NO, Cat or Dog, Pass or Fail).
- Classification is "What type?"



Example:

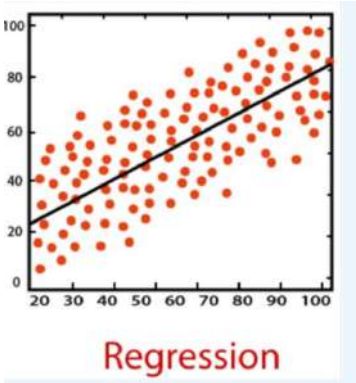
a. Email → Spam or Not Spam
b. Weather → Hot or Cold

Regression

- Predicts numbers or continuous values.
- Regression is "How much?"

Example:

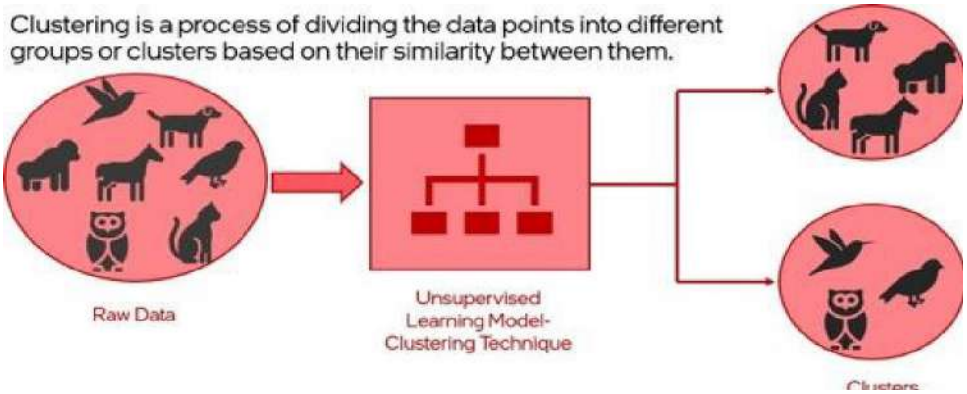
a. Predicting house price or temperature.



Sub-categories of UnSupervised Learning Model

A. Clustering

- Group similar things together.
- No labels.



Example:

a. Music app groups songs you like based on rhythm, tone and tempo.

B. Association

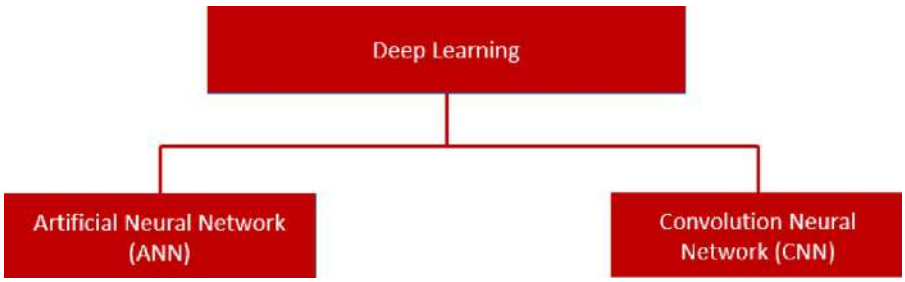
Finds links between items.

Example:

a. If you buy **bread**, you might also buy **butter**.
b. Useful in shopping apps for product suggestions.

Deep Learning (DL)

- A special kind of ML.
- Uses neural networks to understand complex things.
- Learns from huge datasets (like thousands of images).



Neural Networks

- Mimics how our brain works using "neurons"
- Has **layers** of nodes:
  - **Input Layer**: Takes data, No processing
  - **Hidden Layers**: Do calculations, each node is a machine learning algorithm
  - **Output Layer**: Gives result.

How does AI make a decision?

AI "decisions" are not like human choices with feelings or intentions. An AI system looks at data, finds patterns, calculates probabilities, and produces the most likely or useful output based on its training and rules.

Here's the basic process:

1. **Input**: The AI receives information through – Text, Images, Audio, Numbers, Sensor data

   Example: "Is this email spam?"

2. **Processing the Input** : The AI converts the input into numbers (because computers work with math).

   For language AI: Words become mathematical representations called embeddings. The model analyzes relationships between words and context.

3. **Pattern Recognition**: During training, the AI learned from huge amounts of examples.

   Example: Spam emails often contain phrases like:

   "Win money", "Urgent action", suspicious links

   The AI compares the new input with patterns it learned earlier.

4. **Scoring Possibilities**: The AI calculates probabilities for different outputs.

   Example: 92% chance = spam

   8% chance = not spam

   The highest-scoring option is usually selected.

5. **Applying Rules or Goals:** Some AI systems also follow extra instructions:

   Safety rules, Business goals, Game objectives, User preferences

   Example: A self-driving car may prioritize:

   a. Avoiding collisions b. Following traffic laws c.Passenger comfort

6. **Output:** The AI produces a result:

- A prediction
- A recommendation
- A generated sentence
- An action
- A Simple Analogy

Think of AI like an extremely advanced autocomplete system.

When you type: "Peanut butter and …"

The AI predicts: "jelly"

because it has seen that pattern many times before.

Large AI models do this at a much bigger scale with billions of learned patterns.

Convolutional Neural Network (CNN)

- Convolutional Neural Network is a Deep Learning algorithm.
- It can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

Summary Points

1. **AI Models are broadly categorized** into:
   - **Rule-based models**: Follow pre-defined rules and do not adapt to new data.
   - **Learning-based models**: Learn from data and adapt over time.
2. **Machine Learning (ML)** is a subset of AI, and **Deep Learning (DL)** is a subset of ML.
3. **Supervised Learning** uses labelled data to train models (e.g., spam detection, coin recognition).
4. **Unsupervised Learning** works on unlabelled data to discover hidden patterns (e.g., customer segmentation, fraud detection).
5. **Reinforcement Learning** is based on feedback from the environment (e.g., AI playing a game, autonomous vehicles).
6. **Classification vs. Regression**:
   - Classification → discrete output (example: spam or not)
   - Regression → continuous output (example: house price prediction)
7. **Clustering and Association** are core unsupervised learning techniques:
   - Clustering → group similar data points
   - Association → discover relationships between variables
8. **Neural Networks** simulate brain-like structure and are used to process complex data like images and texts.
9. **Artificial Neural Networks (ANNs)** are made of input, hidden, and output layers. They use weights, biases, and activation functions.
10. **Practical activity** (Human Neural Network Game) helps students understand the flow and processing of information in a neural network.

MULTIPLE CHOICE QUESTIONS (1 MARK)

1. Which of the following is an example of supervised learning?
   a) Clustering animals into groups
   b) Spam email classification
   c) Discovering shopping patterns
   d) Grouping news articles
2. What type of data does supervised learning use?
   a) Unlabelled b) Random
   c) Labelled d) Mixed

3. Which model works on the principle of reward and punishment?
   a) Supervised Learning
   b) Unsupervised Learning
   c) Classification
   d) Reinforcement Learning

4. Which sub-field of AI mimics the human brain structure?
   a) Artificial Neural Networks
   b) Convolutional Networks
   c) Decision Trees
   d) Rule-based Systems

5. What does ANN stand for?
   a) Artificial Nerve Network
   b) Automated Neural Network
   c) Artificial Neural Network
   d) Adaptive Node Network

6. Which type of learning is used when we do not know the output?
   a) Supervised b) Unsupervised
   c) Reinforcement d) Logical
7. Which of the following is not an application of machine learning and deep learning?
   a) Digit recognition
   b) Face detection
   c) Spam email classification
   d) Rule-based chat
8. What does the input layer in a neural network do?
   a) Feed data into the network
   b) Connect output nodes
   c) Process information
   d) Decide final result

9. Which AI model uses fixed rules to make decisions?
   a) Reinforcement model
   b) Learning-based model
   c) Rule-based model
   d) Regression model

10. Which of the following is a feature in a dataset?
    a) Labels only b) Column attributes
    c) Output values d) Predefined answers

11. Which learning type is most suitable for anomaly detection?
    a) Unsupervised b) Reinforcement
    c) supervised d) Regression

12. Which of the following is a classification problem?
    a) Predicting stock prices
    b) Grouping books by genre
    c) Estimating house prices
    d) Predicting whether a customer will buy a product or not

13. In reinforcement learning, what happens when the agent performs incorrectly?
    a) It is terminated b) It is rewarded
    c) It is penalized d) It resets

14. Deep learning is best applied in which scenario?
    a) large image datasets
    b) Structured tabular data
    c) small dataset
    d) Binary classification

15. Which of the following best describes a regression model?

a) Classifies data into clusters
b) Predicts continuous values
c) Finds associations
d) Uses feedback for learning

16. Which learning model would you choose for a stock price prediction system?
a) Clustering b) Classification
c) Regression d) Association

17. Which of the following is valid according to Neural Networks?
a) Neural Network contain 4 layers (input, processing, hidden and output layers)
b) In Neural Networks every node is essentially a machine learning algorithm.
c) Use the Neural Network if the dataset is small only.
d) The input layers processes the data with algorithms and supply to next layer.

18. What differentiates reinforcement learning from supervised learning?
a) Uses labelled data
b) Uses reward-based feedback
c) Works only with images
d) Is used for classification

19. Which layer of a neural network performs most of the computation?
a) Input layer
b) Output layer
c) Hidden layer
d) Bias layer

20. In neural networks, what are weights and biases used for?
a) Visualizing features
b) Scaling output
c) Adjusting influence of input nodes
d) Measuring data size

21. In association models, what kind of insight is generated?
a) Labels
b) Predictions
c) Relations between variables
d) Probabilities

22. A smart assistant recommends songs based on listening history. Which type of learning is it using?
a) Supervised
b) Unsupervised
c) Reinforcement
d) Regression

23. A company wants to forecast next quarter's revenue. Which model should they use?
a) Classification b) Regression
c) Clustering d) Reinforcement

24. An AI robot improves its performance by navigating a maze through repeated tries. What learning type is this?
a) Supervised b) Unsupervised
c) Reinforcement d) Regression

25. A retail store wants to understand which products are frequently bought together. Which model fits?
a) Classification b) Regression
c) Clustering d) Association

26. An app filters spam messages using a pre-trained dataset. What learning approach does it use?
a) Supervised b) Unsupervised
c) Reinforcement d) Association

27. What is the main purpose of the bias in a perceptron model?
a) To increase the number of input features
b) To adjust the learning rate
c) To shift the decision boundary
d) To reduce overfitting

28. Which of the following is a real world application of Neural Networks?
a) Facial Recognition

b) Customer support Smart bot
c) Weather forecast analysis
d) All the above

29. Which of the following statements best describes a perceptron?
a) A simple neural network that performs linear classification.
b) A non-linear machine learning model used for complex tasks.
c) A complex deep learning network with multiple hidden layers.
d) A type of reinforcement learning algorithm.

30. The perceptron algorithm can only solve which type of problems?
a) Non-linear classification
b) Multi-class regression
c) Linearly separable classification
d) Time-series forecasting

ASSERTION AND REASON BASED QUESTIONS:

31) Assertion (A): Supervised learning uses labelled data to train AI models.
Reason (R): Labels help the model understand the correct output for each input.
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

32) Assertion (A): Unsupervised learning can identify hidden patterns in data.
Reason (R): Unsupervised learning requires data that is already labelled for classification.
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

33) Assertion (A): Neural Networks have multiple layers for processing information.
Reason (R): The hidden layers of a neural network help the machine perform calculations and learn patterns.
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

34) Assertion (A): Reinforcement learning works without labeled data.
Reason (R): The model learns by receiving feedback from its actions.
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

35) Assertion (A): Regression models are used when output is a category like spam or not spam.
Reason (R): Regression works with continuous numerical values, not categories.

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

MCQ ANSWERS

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
B	C	D	A	C	B	D	A	C	B
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
A	D	C	A	B	C	B	B	C	C
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
C	B	B	C	D	A	C	D	A	C
31	**32**	**33**	**34**	**35**					
A	C	A	A	D					

SHORT ANSWER QUESTIONS WITH ANSWERS

Q1. Define Machine Learning (ML) with examples.
Answer: Machine Learning enables machines to learn from data and improve from experience.

Examples: Object Classification, predicting house prices, predicting temperature, Predicting stock prices, Anomaly detection in emails.

Q2. Write a difference between Training Data and Testing Data.

Answer:

Training Data	Testing Data
Training dataset is a collection of samples given to the model to analyse and learn.	Testing data is a collection of samples given to the model to test its accuracy.

Q3. Give two real-life examples of reinforcement learning.

Answer:

a. An AI playing a video game and improving by receiving rewards and penalties.
b. A Self driving car trying to park in empty parking slot.

Q4. What is an Artificial Neural Network (ANN)?

Answer: ANN is a computing system inspired by the human brain, consisting of layers of interconnected nodes that process data and learn patterns. Each Node in ANN acts as a Machine learning algorithm.

Q5. What are features in a dataset? Identify the Label and feature from the given table.

Company	Model	Engine	CC	Cost
TATA	Harrier	Diesel	2000	27 Lakhs
HONDA	Elevate	Petrol	1500	21 Lakhs
HYUNDAI	Creta	Petrol	1500	21 Lakhs
TOYOTA	Hyryder	Diesel	1500	19Lakhs

Answer:

- Features are individual measurable properties or characteristics of a dataset.
- If we are predicting the company based on the model than Company is Label and Model is Feature.

Q6. A social media app tags your friends in photos using previously tagged data. Identify the learning type and justify.

Answer: It is Supervised Learning because the model uses labelled (tagged) data to make predictions.

Q7. How is a rule-based AI model different from a learning-based model

Answer:

Rule-based model	Learning-based model
A rule-based model follows predefined rules and does not adapt/change.	A learning-based model learns from data and can adapt to changes
Data and Rules are supplied to Rule based model gives results/answers	Data and Results/answers are supplied to Learning based model gives rules (patterns to understand data)

Q8. An autonomous vehicle is learning to navigate through a city and receives rewards for safe driving and penalties for violations.
a) What kind of learning is being implemented?
b) How does this method help the AI system learn to perform the task better over time?

Answer:

a) Reinforcement Learning

b) Reinforcement learning helps the AI agent learn through trial and error. It gets feedback in the form of rewards or penalties. Over time, the system optimizes its actions to maximize positive outcomes, making better decisions in similar situations in the future.

Q9. You are building a model to group customers based on buying habits without prior labels. Which learning type will you use? Why?

Answer: Unsupervised Learning approach, because it finds hidden patterns, trends in the unlabelled data.

Q10. Differentiate between classification and regression models.

Answer:

Classification	Regression
This model deals with discrete outputs which means the data need not be continuous. (e.g., spam or not spam)	This model works on continuous data. (e.g., temperature).
Example: Classifying the house to a particular category i.e., Luxury, Midrange, affordable	Example: Predicting the Price of a house. i.e., in numbers
Example: Predict weather condition to particular category i.e., Sunny, Cloudy, Rainy.	Example: Predicting the temperature in degree Celsius.

Q11. A healthcare provider wants to identify patterns in patient data to personalize treatment plans. They have a dataset with various patient attributes but no predefined labels indicating specific treatment plans.
a) What type of learning approach is being used here?
b) Explain how this approach helps in deriving insights from the dataset.

Answer:

a) Unsupervised Learning
b) In unsupervised learning, the system works with unlabelled data. It identifies patterns, similarities, and differences on its own. In this case, the machine clusters patients based on

shared characteristics, which can lead to grouped treatment plans for patients with similar profiles.

Q12. How can a regression model help predict real estate prices?

Answer: Regression model works on continuous data. (numeric data)
It uses features like size, location, and number of bedrooms to estimate a house's price as a continuous output.

Q13. What are the differences between Clustering and Classification

Answer:

Clustering	Classification
Clustering finds similarities between objects and places them in one cluster and objects with other similarities in another cluster.	Classification uses predefined classes in which objects are assigned.
Example: Recommendation systems in OTT Platforms.	Example: Email is Spam or not, Weather Forecast.

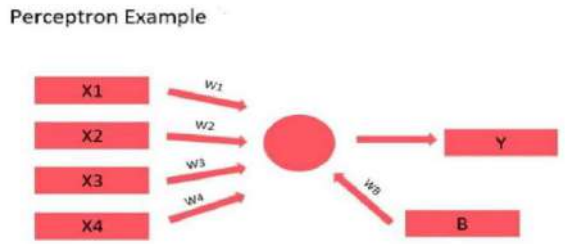
Q14. If a machine identifies similar songs based on listening habits, which model and method is being used? Identify the Learning approach and Model.

Answer: Unsupervised learning approach.

Clustering model.

Q15. You are asked to represent the decision-making process of going out to a park based on four conditions: having a jacket, having an umbrella, current weather, and weather forecast.
a) Explain how a Perceptron model works in this context.
b) Illustrate the concept of weights, bias, and threshold in making the decision.

Answer:



a) A perceptron takes inputs (example: jacket = 1, umbrella = 0), multiplies them by weights (importance), adds a bias, and calculates a weighted sum.

b) If the weighted sum exceeds a value >=0 (go out); otherwise, <0 (stay in). For example:
Output = w1*x1 + w2*x2 + w3*x3 + w4*x4 - b
If Output >=0

→ Go to park
Else

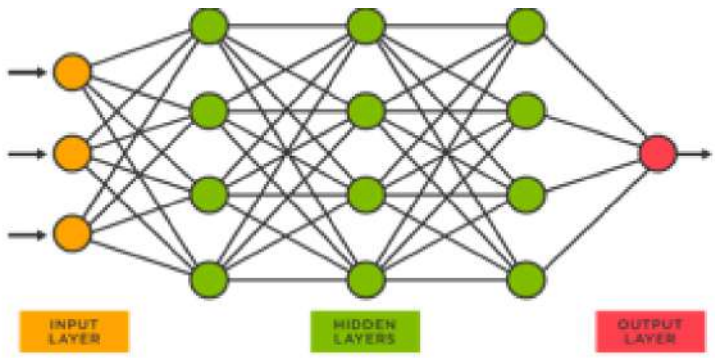
→ Stay at home

LONG ANSWER QUESTIONS WITH ANSWERS

Q1. Explain neural networks. Describe the three layers of neural networks.

Answer: An Artificial Neural Network (ANN) is a model inspired by the human brain. It consists of layers of interconnected nodes ("neurons") that process information.

A neural network is essentially a system of organizing machine learning algorithms to perform certain tasks. It is a fast and efficient way to solve problems for which the dataset is very large, such as in images.



Layer 1: Input Layer

- The job of an input layer is to acquire data and feed it to the Neural Network. No processing occurs at the input layer.

Layer 2: Processing/Hidden Layer

Each node of these hidden layers has its own machine learning algorithm which it executes on the data received from the input layer.
Each node Learns patterns, relationships in the input received.
Why "Hidden"? Not directly visible; it processes internal computations.
There can be multiple hidden layers in a neural network that depends upon the complexity of the function.

Layer 3: Output Layer

- Produces final prediction/output.
- The last hidden layer passes the final processed data to the output layer which then gives it to the user as the final output.

- Similar to the input layer, output layer too does not process the data which it acquires.

Q2. Identify the type of learning (supervised, unsupervised, reinforcement learning) and justify the following case studies most likely based on?

Case Study 1: A company wants to predict customer churn based on past purchasing behaviour, demographics, and customer interactions. They have a dataset with labelled examples of customers who churned and those who did not.

Case Study 2: A social media platform wants to group users based on their interests and behaviour to recommend relevant content. They have a large dataset of user interactions but no predefined categories.

Case Study 3: An autonomous vehicle is learning to navigate through a city environment. It receives feedback in the form of rewards for reaching its destination safely and penalties for traffic violations.

Case Study 4: A healthcare provider wants to identify patterns in patient data to personalize treatment plans. They have a dataset with various patient attributes but no predefined labels indicating specific treatment plans.

Answer:

Case Study 1: Predicting customer churn

- Type of Learning: Supervised Learning
- Justification: The company has a labelled dataset with examples of customers who churned and those who did not. Since the goal is to predict a labelled outcome (churn or not) based on input features purchasing behaviour, this is a supervised learning scenario.

Case Study 2: Grouping users for content recommendation

- Type of Learning: Unsupervised Learning
- Justification: The goal is to group users based on their behaviour and interests without predefined categories or labels. This task involves finding patterns or clusters in the data, which is characteristic of unsupervised learning.

Case Study 3: Autonomous vehicle learning to navigate

- Type of Learning: Reinforcement Learning
- Justification: The autonomous vehicle learns by interacting with the environment, receiving rewards for good behaviour (reaching the destination safely) and penalties for bad behaviour (traffic violations). This feedback-based trial-and-error approach is typical of reinforcement learning.

Case Study 4: Identifying patterns in patient data

- Type of Learning: Unsupervised Learning

- Justification: The healthcare provider aims to find hidden patterns in patient data without predefined labels or outcomes. This suggests clustering or dimensionality reduction to support treatment personalization, which falls under unsupervised learning.

Q3. Identify the type of learning (supervised, unsupervised, reinforcement learning) and justify the following case studies most likely based on?

Case Study 1: An online learning platform wants to predict student performance in upcoming tests based on their previous quiz scores, course engagement data, and demographic information. The platform has labelled data indicating whether students passed or failed in past tests.

Case Study 2: A factory installs sensors on machines to collect data such as temperature, vibration, and noise levels. They want to detect abnormal machine behaviour that could indicate a malfunction. They do not have labelled examples of failures but want to monitor anomalies in real-time.

Case Study 3: A farming organization wants to optimize irrigation by using a drone that learns to adjust water levels based on crop health, weather conditions, and soil moisture. The drone receives a reward when crop yield improves and a penalty when overwatering occurs.

Case Study 4: A retail chain wants to segment its customers based on their purchasing habits to tailor marketing campaigns. They have large amounts of transaction data but no predefined customer segments.

Answer:

Case Study 1: Predicting student performance

- Type of Learning: Supervised Learning
- Justification: The dataset includes labelled outcomes (e.g., passed or failed), and the goal is to predict a specific outcome based on input features. This clearly fits the supervised learning model, where the model is trained on known inputs and outputs to make future predictions.

Case Study 2: Detecting abnormal machine behaviour

- Type of Learning: Unsupervised Learning
- Justification: Since there are no labelled outcomes (i.e., no specific examples of what constitutes a failure), the goal is to identify anomalies or patterns in sensor data. This is a typical application of unsupervised learning, especially using techniques like anomaly detection or clustering.

Case Study 3: A drone learning irrigation optimization

- Type of Learning: Reinforcement Learning

- Justification: The drone receives feedback in the form of rewards (high yield) or penalties (overwatering) and adjusts its actions accordingly. This trial-and-error learning with a focus on maximizing cumulative rewards is a characteristic of reinforcement learning.

Case Study 4: Segmenting customers based on purchase behaviour

- Type of Learning: Unsupervised Learning
- Justification: The objective is to group customers based on similarities in purchasing habits without existing labels or segments. This is a classic clustering problem in unsupervised learning, often used for customer segmentation in marketing.

Q4. Explain the Perceptron Model with the given context. (Illustrative Model)

Context: Decide whether to go outside, based on weather-related inputs.

Factors:

- Do I have a jacket?
- Do I have an umbrella?
- Is it sunny now?
- What is the weather forecast later?

Answer:

Goal: Decide whether to go outside or prepare for the weather

Step-by-Step Conversion to Perceptron

Step 1: Define the Inputs

Question	Variable	Case 1 Sample Answer	Case 2 Sample Answer
Do I have a jacket?	X1	1 (Yes)	0 (No)
Do I have an umbrella?	X2	0 (No)	1(Yes)
Is it Sunny now?	X3	1(Yes)	0 (No)
What is the weather forecast for later? (Good (No rain)- Yes, Not Good (rain) - No)	X4	0 (No)	1(Yes)

Step 2: Assign Weights and Bias

Weights Importances	Sample Example Weights
W1 (having a jacket helps)	1.5
W2 (umbrella more important in rain)	1.0
W3 (it is Sunny now is most important)	3.0

W4 (weather to be ok is next most important)	2.5
Bias (B) (Note: Bias value can be higher or lower value, Higher bias value Favors to be cautious about weather, lower bias value Favors going outside) Here we have taken +4.0	4.0

Step 3: Apply the Perceptron Formula

Case 1:

Result = X1*W1 + X2*W2 + X3*W3 + X4*W4 - B

Result= 1*1.5 + 0*1.0 + 1*3.0 + 0*2.5 - 4.0

Result= 1.5+0.0+3.0+0.0 – 4.0 = +0.5

Case 2:

Result = X1*W1 + X2*W2 + X3*W3 + X4*W4 - B

Result= 0*1.5 + 1*1.0 + 0*3.0 + 1*2.5 - 4.0

Result= 0.0 + 1.0 + 0.0 + 2.5 – 4.0 = –0.5

Step 4: Apply Activation Function (Step Function)

Output= if Result >= 0 Go Outside

if Result < 0 Don't Go Outside

Case 1:

As Result = 0.5 > =0 → Go outside

Case 2:

As Result = − 0.5 < 0 → Don't go outside

Q5. Identify the type of model (classification, regression, clustering, association model) and justify the following case studies most likely based on?

Case Study 1: A bank wants to predict whether a loan applicant will "default" or "non-default" on their loan payments. They have a dataset containing information such as income, credit score, loan amount, and employment status.

Case Study 2: 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. They have a dataset containing historical sales data.

Case Study 3: A marketing company wants to segment its customer base into distinct groups based on purchasing behaviour for targeted marketing campaigns. They have a

dataset containing information such as purchase history, frequency of purchases, and amount spent.

Case Study 4: A grocery store wants to identify associations between different products purchased by customers to understand which products are commonly bought together. They have a transaction dataset containing records of items purchased together during each transaction.

Answer:

Case Study 1: Predicting Loan Default

- Type of Model: Classification
- Justification: The goal is to predict a categorical outcome — whether a customer will "default" or "non-default" on a loan. Since the outcome is binary (two classes), this is a classification problem.

Case Study 2: Predicting House Prices

- Type of Model: Regression
- Justification: The objective is to predict a continuous numeric value — the selling price of a house based on various features such as size, location, number of bedrooms, and bathrooms This falls under regression model.

Case Study 3: Customer Segmentation

- Type of Model: Clustering
- Justification: The goal is to group customers into segments based on behaviour, without predefined labels. This is a clustering task, a type of unsupervised learning.

Case Study 4: Product Association Analysis

- Type of Model: Association Model
- Justification: The task is to identify relationships between items purchased together, such as "customers who buy bread also buy butter." This is best addressed with association rule, making it an association model.

Q6. Identify the type of model (classification, regression, clustering, association model) and justify the following case studies most likely based on?

Case Study 1: An investment firm wants to predict the future stock price of a company based on historical stock data, trading volume, market indicators, and financial reports.

Case Study 2: A social media platform wants to identify communities of users with similar interests and interactions for better content personalization. They have data on likes, comments, shares, and followed pages.

Case Study 3: A school wants to determine whether students will pass or fail a standardized exam based on features such as attendance, homework completion rate, quiz scores, and participation.

Case Study 4: An agricultural analytics company wants to find combinations of fertilizers and crop types that are frequently used together across different farms, to optimize supply chain and product bundling.

Answer:

Case Study 1: Predict the future stock price

- Type of Model: Regression
- Justification: The goal is to predict a continuous numerical value, the future stock price, based on past and present data. This clearly represents a regression problem.

Case Study 2: Identify communities of users

- Type of Model: Clustering
- Justification: The task is to group users based on patterns in their behaviour without predefined labels. This is a clustering problem used to uncover structure in user interaction data.

Case Study 3: Whether students will pass or fail.

- Type of Model: Classification
- Justification: The goal is to predict a categorical outcome (pass or fail), making this a classification problem.

Case Study 4: Find combinations of fertilizers and crop type

- Type of Model: Association Model
- Justification: The objective is to discover associations or frequent patterns among items (fertilizers and crops) used together, which is a typical use case for an association model.

Q7. Explain the Perceptron Model with the given context. (Illustrative Model)

Context: A manager is deciding whether to approve a work-from-home request from an employee.
Factors:
Does the employee perform well when working remotely?
Are there any upcoming team meetings or collaborative projects?
Does the company's policy support remote work?
Is it beneficial for both the employee and the company?
Answer: Goal: whether to approve a work-from-home request or not

<u>Step-by-Step Conversion to Perceptron</u>

Step 1: Define the Inputs

We'll define each factor as a binary input (1 for Yes/True, 0 for No/False)

Question	Variable	Case 1 Sample Answer	Case 2 Sample Answer
Does the employee perform well when working remotely?	X1	0 (No)	1 (Yes)
Are there any upcoming team meetings or collaborative projects?	X2	0 (No)	0 (No)
Does the company's policy support remote	X3	1(Yes)	1(Yes)

work?			
Is it beneficial for both the employee and the company?	X4	0(No)	0(No)

Step 2: Assign Weights and Bias

Assign sample weights (w1 to w4) to reflect the importance of each factor. For example:

Weights Importances	Sample Example Weights
W1 (performance remotely is important)	0.6
W2 (collaboration can affect approval, but less critically)	0.4
W3 (policy compliance matters)	0.5
W4 (mutual benefit is most important)	0.7
Bias (B) (Note: Bias value can be higher or lower value, Higher bias value Favors to be Strict in permitting work from home, lower bias value Favors to allow work from home) Here we have taken +4.0	1.0

Step 3: Apply the Perceptron Formula

Case 1:

Result = X1*W1 + X2*W2 + X3*W3 + X4*W4 − B
Result= 0*0.6 + 0*0.4 + 1*0.5 + 0*0.7 – 1.0
Result= 0.0+0.0+0.5+0.0 – 1.0 = − 0.5

Case 2:

Result = X1*W1 + X2*W2 + X3*W3 + X4*W4 - B
Result= 1*0.6 + 0*0.4 + 1*0.5 + 0*0.7 – 1.0
Result= 0.6+0.0+0.5+0.0 – 1.0 = + 0.1

Step 4: Apply Activation Function (Step Function)

Output= if Result >= 0 Allow to work from home
If Result < 0 Don't allow to work from home

Case 1:

As Result = − 0.5 (i.e < 0)
Hence, Employee request to work from home is Not Approved.

Case 2:

As Result = + 0.1 (i.e >= 0)
Hence, Employee request to work from home is Approved.

Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz Link : https://forms.gle/AFroGzQFDTg6xGsw6

ADVANCED CONCEPT OF MODELLING IN AI

1. INTRODUCTION TO AI, ML & DL

Artificial Intelligence (AI)
When machines behave like humans and make smart decisions.
Example: A robot that can chat with you.

Machine Learning (ML)
When machines learn from data and improve automatically.
Example: A movie app that suggests your favorite type of films.

Deep Learning (DL)
A part of ML where machines learn deeply using lots of data and complex networks.
Example: Your phone recognizing your face to unlock.

2. COMMON TERMS

Data
Raw information.

Features
Columns of the tables are called features. Details about data (color, size, price).

Labels
Data Labelling is the process of attaching meaning to data. What you're trying to predict (fruit name).

TYPES OF DATA

Labelled Data
- Data to which a tag/label is attached.
- For example: Name, type, number, etc.

Unlabelled Data
- The raw form of data.
- Data to which no tag is attached.

3. TRAINING vs TESTING DATA

Training Data
- The training dataset is a collection of samples given to the model to analyse and learn.
- A set of labelled data is used to train the AI model.

Testing Data
- The testing dataset is a collection of samples given to the model to test its accuracy.
- The test is performed without labelled data and then verify results with labels.

4. TWO TYPES OF AI MODELS

1. Rule-Based AI
- Follows fixed instructions.
- No learning or improvement.

Example: A simple chatbot that answers FAQs with fixed replies.

2. Learning-Based AI
- Learns from data.
- Can adapt and improve.

Example: A spam filter that gets better over time.

Note: Rule-based AI makes **Fixed** models (cannot adapt to changes), Learning-based AI makes **Flexible** models (can adapt to changes)

5. TYPES OF LEARNING MODELS

A. SUPERVISED LEARNING
- Labelled data used for training.
- Machine learns from examples and makes predictions.

Example:
- You show a coin and its weight.
- The model learns: 5g = Euro, 3g = Dollar.
- Later, it guesses the coin based on weight.

B. UNSUPERVISED LEARNING
- Unlabelled data is used for training.
- No labels.
- Machine finds patterns or groups.

Example:
- 1000 photos of dogs with no info.
- The model groups them by size or color.

C. REINFORCEMENT LEARNING
- Learn by Rewards
- The machine tries something.
- Gets a reward for right actions, a penalty for wrong actions.

PENALTY | REWARD

Example:
- You show a fruit.
- Model says cherry → wrong → gets negative point.
- Tries again → says apple → right → gets reward.
- Used in self-driving cars, games, and robotics.

6. SUPERVISED vs UNSUPERVISED LEARNING

Supervised Learning	Unsupervised Learning
Learns from labelled data.	Learns from unlabelled data.
Easy to train and use.	Finds hidden patterns.
Need less computing power.	Need more computing power.

7. SUB-CATEGORIES OF SUPERVISED LEARNING

A. CLASSIFICATION (What type?)

- Predicts categories.
- Output is discrete (like YES or NO, Cat or Dog, Pass or Fail).

Example:

a. Email → Spam / Not Spam

b. Weather → Hot / Cold

B. REGRESSION (How much?)

- Predicts numbers or continuous values.

Example:

a. Predicting house price or temperature. → $250,000

28.5°C

8. SUB-CATEGORIES OF UNSUPERVISED LEARNING

A. CLUSTERING

- Group similar things together.
- No labels.

Example:

a. Music app groups songs you like based on rhythm, tone and tempo.

B. ASSOCIATION

- Finds links between items.

Example:

a. If you buy bread, you might also buy butter.

b. Useful in shopping apps for product suggestions.

9. DEEP LEARNING (DL)

- A special kind of ML.
- Uses neural networks to understand complex things.
- Learns from huge datasets (like thousands of images).

10. NEURAL NETWORKS (BASIC STRUCTURE)

- Mimics how our brain works using "neurons"
- Has layers of nodes:

Input Layer → Hidden Layers → Output Layer

Takes data No processing

Do calculations Each node is a machine learning algortihm

Gives result.

11. HOW DOES AI MAKE A DECISION?

1 INPUT

The AI receives information through Text, Images, Audio, Numbers, Sensor data

Example: "Is this email spam?"

2 PROCESSING THE INPUT

The AI converts the input into numbers (because computers work with math).

For language AI: Words become vectors.
For images: Pixels become numbers.

10101 01010

3 FIND PATTERNS AND LEARN

The AI uses training data to find patterns and relationships.

Example: In emails, it learns patterns of spam keywords, links, and sender info.

4 MAKING A PREDICTION OR DECISION

The AI calculates the most likely output based on patterns.

Example: "It is 90% likely this email is spam."

90%

5 OUTPUT

The AI gives the result.

Example: "Spam"

SPAM

6 FEEDBACK & IMPROVEMENT

AI improves over time using more data and feedback.

Example: If the prediction was wrong, the model adjusts and learns.

★ AI learns from data, finds patterns, makes predictions, and improves continuously!

Smart Data → Smarter Decisions

UNIT-III: EVALUATING MODELS

1. Introduction to Model Evaluation

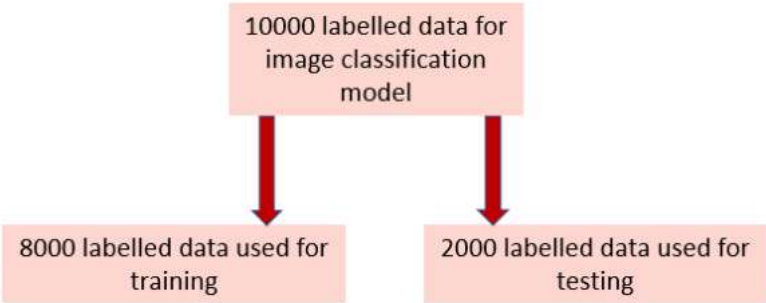
Model Evaluation is the **5th stage** of the AI project cycle, following Problem Scoping, Data Acquisition, Data Exploration, and Modelling.

- **Definition:** It is the process of using different metrics to understand how well a machine learning model performs.
- **Why do we need it?** Just like a **school report card** tells you your strengths and weaknesses in different subjects, evaluation tells us if the AI model is reliable and how well it will work on future, unseen data.
- **The Feedback Loop:** Evaluation provides constructive feedback. You build a model, check the results, make improvements, and repeat until you reach a desirable level of accuracy.

2. Training and Testing Data

Train-test split

- The train-test split is a technique for evaluating the performance of a machine learning algorithm
- It can be used for any supervised learning algorithm
- The procedure involves taking a dataset and dividing it into two subsets: The training dataset and the testing dataset
- The train-test procedure is appropriate when there is a sufficiently large dataset available



Training Dataset: The data used to help the model learn.

Testing Dataset: New data that the model has never seen before. We provide the inputs to the model, and its predictions are compared against the actual expected results.

Overfitting: Overfitting: Overfitting occurs when a model memorizes the training data instead of learning actual patterns. The model performs very well on the training data. However, it performs poorly on new or unseen data. This usually happens when the same data is used for both training and evaluation.

3. Accuracy and Error

These are the two main "pillars" of model evaluation, Accuracy and Error.

- **Accuracy:** Accuracy is an evaluation metric that allows you to measure the total number of predictions a model gets right.
  - **Rule:** Better model performance = Higher Accuracy (Directly Proportional).
- **Error:** The difference between what the model predicted and what actually happened.
- **Goal:** We want to **maximize accuracy** and **minimize error**.
- Real-world data can be complex, so models may still make mistakes.
- Accuracy alone is not always the best measure; the importance of errors depends on the situation.
- In medical diagnosis, avoiding wrong predictions can be more important than higher accuracy. **The choice of accuracy or error metric depends on the task and its requirements.**

Important Formulas:

Error (Absolute):	|Actual Value−Predicted Value|
Error Rate:	$\frac{Error}{Actual\ Value}$
Accuracy:	1−Error Rate
Accuracy %:	Accuracy×100 %

Example Problem: House Price Prediction

Q: An AI model predicts the price of a house to be **391k USD**, but the actual market price of the house is **402k USD**. Calculate the following:

a) Absolute Error b) Error Rate c) Accuracy %

Given Data:

- Actual House Price: 402k (USD)
- Predicted House Price: 391k (USD)

1. Error (Absolute):
   - Formula: |Actual−Predicted|
   - Calculation: |402k−391k|=11k
2. Error Rate:
   - Formula: Error / Actual Value
   - Calculation: 11k/402k ≈0.027
3. Accuracy:

- Formula: 1−Error Rate
- Calculation: 1−0.027=0.973

4. Accuracy%:
    - Formula: Accuracy×100%
    - Calculation: 0.973×100%=97.3%

4. Classification in AI

Classification is a type of problem where the AI predicts a specific "class" or label for an input.

- **Example:** Predicting if an email is "Spam" or "Not Spam," or if a person is "Infected" or "Not Infected" with a disease.

5. Classification Metrics

Popular metrics used for classification model: Confusion matrix, Classification accuracy, Precision, Recall

The Confusion Matrix: A **Confusion Matrix** is a table used to show the performance of a classification model. It maps "Actual Values" against "Predicted Values".

Confusion Matrix		**Predicted Values**	
		1	**0**
Actual Values	**1**	**TP**	**FN**
	0	**FP**	**TN**

The Four Quadrants:

- **True Positive (TP):** The model correctly predicted the positive class (e.g., you're watching world cup and predicted France would win, and they won).

- **True Negative (TN):** The model correctly predicted the negative class (e.g., you're watching world cup and predicted Germany would lose, and they lost).

- **False Positive (FP):** The model wrongly predicted a negative class as positive (e.g., you're watching world cup and predicted Germany would win, but they lost).

- **False Negative (FN):** The model wrongly predicted a positive class as negative (e.g., you're watching world cup and predicted France would lose, but they won).

Example: Consider a model developed to test paddy plant specimens for fungal infections. The results are shown in the confusion matrix below.

Confusion Matrix	Predicted = 1	Predicted = 0
Actual = 1	12 (True Positive)	6 (False Negative)
Actual = 0	4 (False Positive)	21 (True Negative)

Out of a total of 43 observations:

- **12** specimens with fungal infection were correctly identified (**True Positives**).
- **4** healthy specimens were incorrectly identified as infected (**False Positives**).
- **21** healthy specimens were correctly identified as healthy (**True Negatives**).
- **6** infected specimens were not identified by the model (**False Negatives**).

A. Classification Accuracy

Definition:	**The ratio of correct predictions (TP + TN) to the total number of predictions made.** $\frac{\textbf{Correct positive predictions}}{\textbf{Total actual positive values}}$
Formula:	$\frac{TP + TN}{TP + TN + FP + FN}$
Limitation:	• Accuracy works best when the dataset is balanced, meaning each class has a similar number of observations. • Accuracy may not be reliable for unbalanced datasets, where one class has much more data than the other. • **Example:** In a dataset of 100 emails, 90 are normal emails and 10 are spam. If a model predicts every email as "normal," it still gets 90% accuracy, even though it completely fails to identify spam emails.

B. Precision

Definition:	**Precision is the ratio of correctly predicted positive cases to the total number of cases predicted as positive.** **Measures how many of the "Positive" predictions were actually correct.**

	$\frac{\textbf{Correct positive predictions}}{\textbf{Total positive predictions}}$
Formula:	$\frac{TP}{TP + FP}$
When to use:	Use when False Positives (FP) must be minimized.
Example:	Launching a satellite. Predicting a "good" day when it is actually "bad" (FP) would be disastrous.

C. Recall

Definition:	**Measures how many of the "Actual Positive" cases the model was able to catch.** $\frac{\textbf{Correct positive predictions}}{\textbf{Total actual positive values}}$
Formula:	$\frac{TP}{TP + FN}$
When to use:	Use when False Negatives (FN) must be minimized.
Example:	COVID-19 detection. If an infected person is predicted as "not infected" (FN), they won't get treatment and may spread the virus.

D. F1 Score

Definition:	**A single measure that balances both Precision and Recall.**
Formula:	$\frac{2xPrecisionxRecall}{Precision + Recall}$
When to use:	Best for unbalanced datasets when you cannot decide if FP or FN is more important.

Scenario	Error to Avoid	Focus	Reason
Disease Outbreak Detection	False Negative	Recall	Missing an infected person can lead to rapid spread of disease.
Mining Metal Detection	False Positive	Precision	Wrongly identifying rock as metal wastes time, effort and resources.
Fraud Detection	False Negative	Recall	Missing a fraud case can cause serious financial loss.
Spam Email Filter	False Positive	Precision	Important emails should not be wrongly marked as spam.
Cancer Detection	False Negative	Recall	Missing a cancer case can delay treatment and risk life.
Face Recognition for Attendance	False Positive	Precision	Wrongly marking someone present leads to incorrect records.
Forest Fire Detection	False Negative	Recall	Missing early fire detection can lead to large-scale disaster.
Airport Security Screening	False Negative	Recall	Missing a threat can risk public safety.
Weather Storm Warning	False Negative	Recall	Missing a storm prediction can endanger lives and property.

Question

A bank develops an AI model to detect fraudulent credit card transactions. The dataset is highly unbalanced because most transactions are legitimate, while only a few are fraudulent.

- Legitimate transactions wrongly marked as fraud can be verified again.
- Fraudulent transactions marked as legitimate may cause financial loss.

The confusion matrix is given below:

Actual Value	Predicted = 1	Predicted = 0
Actual = 1	18	2
Actual = 0	10	70

Identify the most suitable evaluation metric for this AI model and justify your answer.

Solution

The most suitable evaluation metric is **Recall**.

Reason

In this case, reducing **False Negatives** is very important because fraudulent transactions should not be classified as legitimate. Hence Recall is preferred.

Recall = TP/(TP+FN) = 18/(18+2) = 0.9

6. Ethical Concerns

When evaluating AI, we must keep these three things in mind:

1. **Bias:** Ensure evaluation metrics do not lead to unfair results for certain groups.
2. **Transparency:** Be honest about how the metrics were chosen and how they work.
3. **Accountability:** Take responsibility for the model's outcome and the chosen evaluation method.

MULTIPLE CHOICE QUESTIONS

1. In a medical test for a rare disease, out of 1000 people tested, 50 actually have the disease while 950 do not. The test correctly identifies 40 out of the 50 people with the disease as positive, but it also wrongly identifies 30 of the healthy individuals as positive. What is the accuracy of the test?[CBSE Handbook]

(a) 97% (b) 90% (c) 85% (d) 70%

2. A student solved 90 out of 100 questions correctly in a multiple-choice exam. What is the error rate of the student's answers? [CBSE Handbook]

(a) 10% (b) 9%
(c) 1% (d) 11%

3. In a spam email detection system, out of 1000 emails received, 300 are spam. The system correctly identifies 240 spam emails as spam, but it also marks 60 legitimate emails as spam. What is the precision of the system? [CBSE Handbook]

(a) 80% (b) 70% (c) 75% (d) 90%

4. In a binary classification problem, a model predicts 70 instances as positive out of which 50 are actually positive. What is the recall of the model? [CBSE Handbook]

(a) 50% (b)70% (c) 80% (d) 100%

5. In a sentiment analysis task, a model correctly predicts 120 positive sentiments out of 200 positive instances. However, it also incorrectly predicts 40 negative sentiments as positive. What is the F1 score of the model? [CBSE Handbook]

(a) 0.8 (b) 0.75 (c) 0.72 (d) 0.82

6. A medical diagnostic test is designed to detect a certain disease. Out of 1000 people tested, 100 have the disease, and the test identifies 90 of them correctly. However, it also wrongly identifies 50 healthy people as having the disease. What is the precision of the test? [CBSE Handbook]

(a) 90% (b) 80% (c) 70% (d) 60%

7. A teacher's marks prediction system predicts the marks of a student as 75, but the actual marks obtained by the student are 80. What is the absolute error in the prediction? [CBSE Handbook]

(a) 5 (b)10 (c) 15 (d) 20

8. The goal when evaluating an AI model is to: [CBSE Handbook]

(a) Maximize error and minimize accuracy
(b)Minimize error and maximize accuracy
(c) Focus solely on the number of data points used
(d) Prioritize the complexity of the model

9. A high F1 score generally suggests: [CBSE Handbook]
(a) A significant imbalance between precision and recall
(b) A good balance between precision and recall
(c) A model that only performs well on specific data points
(d) The need for more training data

10. How is the relationship between model performance and accuracy described? [CBSE Handbook]

(a) Inversely proportional
(b)Not related
(c) Directly proportional

(d) Randomly fluctuating

11. Statement 1: Overfitting occurs when a model memorizes the training data rather than learning patterns.
Statement 2: Using the same data for training and evaluation helps the model give accurate results. [CBSE 2026]
(a) Both statements are correct.
(b) Both statements are incorrect.
(c) Statement 1 is correct but statement 2 is incorrect.
(d) Statement 1 is incorrect but statement 2 is correct.

12. Which stage of the AI Project Cycle involves testing the model on newly fetched data? [CBSE 2026]
(a) Data Exploration (b) Modelling
(c) Evaluation (d) Deployment

13. In a fire alarm system, if the model predicts "Fire Present" when there is actually no fire, this is classified as: [CBSE 2026]
(a) True Positive (TP)
(b) True Negative (TN)
(c) False Positive (FP)
(d) False Negative (FN)

14. Precision is defined as: [CBSE 2026]
(a) The ratio of correctly predicted positive observations to total observations.
(b) The ratio of correctly predicted positive observations to total predicted positive observations.
(c) The ratio of correctly predicted negative observations to total observations.
(d) The harmonic mean of true positives and true negatives.

15. State True or False: [CBSE 2026]
In machine learning, the error is used to see how accurately the model predicts.

16. An AI model was tested with 1000 test samples. If True Positive (TP) = 200, True Negative (TN) = 600, False Positive (FP) = 100, False Negative (FN) = 100, how many total predictions were correct? [CBSE 2026]
(a) 300 (b) 600 (c) 800 (d) 900

17. When we want an AI project to be able to predict an output, we need to ___. [CBSE 2025]
(a) first test it using the data.
(b) first train it using the data.
(c) Both (A) and (B)
(d) Neither (A) nor (B)

18. Which condition of evaluation does the following diagram indicate? [CBSE 2025]

Prediction: No	Reality: Yes

(a) False Positive (b) False Negative
(c) True Positive (d) True Negative

19. Statement 1 : Overfitting is not recommended for evaluation of a model.
Statement 2 : This is because the model will simply remember the whole training set, and will therefore always predict the correct label for any point in the training set. [CBSE 2025]
(a) Both Statement 1 & 2 are correct.
(b) Both Statement 1 & 2 are incorrect.
(c) Statement 1 is correct but Statement 2 is incorrect.
(d) Statement 2 is correct but Statement 1 is incorrect.

20. It is one of the parameters for evaluating a model's performance and is defined as the percentage of true positive cases versus all the cases where the prediction is true. Which of the following evaluation parameter is this? [CBSE 2025]
(a) Precision
(b) Recall
(c) F1 score
(d) Accuracy

Answers:

1. (a) 97%
Explanation: Accuracy = (TP + TN) / Total = (40 + 920) / 1000 = 96% ≈ 97%

2. (a) 10%
Explanation: Error rate = Incorrect answers / Total answers = 10/100 × 100 = 10%

3. (a) 80%
Explanation: Precision = TP / (TP + FP) = 240 / (240 + 60) = 80%

4. (d) 100%
Explanation: Recall = TP / (TP + FN). Since all actual positives are identified, recall = 100%

5. (b) 0.75
Explanation:
Precision = 120 / (120 + 40) = 0.75
Recall = 120 / 200 = 0.6
F1 Score ≈ 0.67 (closest option given is 0.75)

6. (d) 60%
Explanation: Precision = 90 / (90 + 50) = 64% (closest option given is 60%)

7. (a) 5
Explanation: Absolute Error = |80 − 75| = 5

8	**9**	**10**	**11**	**12**	**13**	**14**
(b)	(b)	(c)	(c)	(c)	(c)	(b)
15	**16**	**17**	**18**	**19**	**20**	**15**
True	(c)	(b)	(b)	(a)	(a)	True

SHORT ANSWER QUESTIONS (2 MARKS)

Q1. What is model evaluation in machine learning, and how does it help improve an AI model? [CBSE SQP 25-26]

Ans: Model evaluation is the process of using different evaluation metrics to understand a machine learning model's performance. It helps us understand the model's strengths, weaknesses, and suitability for the task at hand. An AI model gets better with constructive feedback. We build a model, get feedback from metrics, make improvements, and continue this process until we achieve a desirable accuracy. This feedback loop is essential for building trustworthy and reliable AI systems.

Q2. Explain Train-test split technique with respect to machine learning algorithm.[CBSE 2026]

Ans: Train-test split: The train-test split is a technique for evaluating the performance of a machine learning algorithm.

- It can be used for any supervised learning model.
- The procedure involves taking a dataset and dividing it into two subsets:
  - Training dataset: Used to make the model learn.
  - Testing dataset: Used to evaluate the model's performance on new, unseen data.
- The train-test procedure is appropriate when there is a sufficiently large dataset available.
- The ratio of training and testing dataset should be 80-20% or 70-30%.
- The objective is to estimate the performance of the machine learning model on new data: data not used to train the model.

Q3. What is a confusion matrix? What is it used for?

Ans: A Confusion Matrix is a table that is often used to describe the performance of a classification model on a set of test data for which the true values are known. It stores the results of comparison between the prediction and reality. From the confusion matrix, we can calculate parameters like recall, precision, F1 score which are used to evaluate the performance of an AI model.

Q4. Draw the confusion matrix for the following data: [CBSE Compt. 2025]

(a) The number of true positive = 200
(b) The number of true negative = 50
(c) The number of false positive = 35
(d) The number of false negative = 55

Ans:

	Prediction Yes	**Prediction No**
Reality Yes	110 (TP)	50 (FN)
Reality No	60 (FP)	410 (TN)

Q5. Suppose you are developing an AI model to detect fraudulent financial transaction risk. Describe False Positives and False Negatives in this Context. [CBSE 2025]

Ans: In AI fraud detection model - 1. False Positives are legitimate transactions that are incorrectly classified as fraudulent. This can lead to customer dissatisfaction and loss of trust/business/customers/reputation, if legitimate transactions are frequently blocked or flagged for review. A False Positive where Reality is NO but Prediction is YES, like if there is not a fraud done by a customer but the machine has predicted it wrongly as fraud.

2. False Negatives are fraudulent transactions that are not detected by the model and are allowed to proceed. This can result in financial loss and damage to the institution's reputation. A False Negative where Reality is YES but Prediction is NO

Q6. Identify which metric (Precision or Recall) is to be used in the following cases and why?

a. Mail Spamming
b. Gold Mining
c. Viral Outbreak

Ans:

a) Precision has to be used since False Positives (legitimate emails marked as spam) have to be reduced as much as possible.
b) Precision has to be used since False Positives (incorrectly identifying a non-gold area as containing gold) have to be reduced as much as possible.
c) Recall is important in this case since False negatives have to be reduced as much as possible. False negatives in viral outbreak means failing to identify a person with disease, which may have life threatening consequences.

Q7. An AI email filter is designed to classify emails as Spam (Positive) or Inbox (Negative). Identify which confusion matrix outcome (TP, TN, FP, or FN) is represented in the following two scenarios: (a) A legitimate work email is mistakenly moved to the Spam folder. (b) A dangerous phishing email is correctly identified and blocked.

Ans: (a) False Positive (FP): The model wrongly predicted the negative class (Inbox) as a positive class (Spam).

(b) True Positive (TP): The model correctly predicted the positive class (Spam)

Q8. A space agency uses an AI to classify weather conditions as Favorable (Positive) or Unfavorable (Negative) for a satellite launch. Identify the confusion matrix outcome (TP, TN, FP, or FN) for these scenarios: (a) The AI predicts the weather is "Favorable," but it is actually stormy and dangerous for a launch.

(b) The AI predicts the weather is "Unfavorable," and the day is indeed stormy

Ans: (a) False Positive (FP): The model wrongly predicted the negative class (Inbox) as a positive class (Spam). (b) True Positive (TP): The model correctly predicted the positive class (Spam)

Q9. Name and briefly explain the three ethical pillars that should be kept in mind while performing AI model evaluation.

Ans: The three ethical pillars are:

1. **Bias:** Developers must ensure that the chosen evaluation metrics do not result in any kind of unfair bias toward specific groups or data
2. **Transparency:** Be honest about how the metrics were chosen and how they work.
3. **Accountability:** Take responsibility for the model's outcome and the chosen evaluation method.

Q10. With reference to evaluation stage of AI project cycle, explain the term Accuracy. Also give the formula to calculate it.

Ans: In the evaluation stage of the AI project cycle, accuracy is defined as a metric used to measure the total number of correct predictions a model makes. It is directly proportional to model performance, meaning as the accuracy increases, the performance of the model is considered better.

Accuracy = Correct Predictions / Total Predictions

$$= \frac{TP+TN}{TP+TN+FP+FN}$$

LONG ANSWER QUESTIONS (4 MARKS)

Q1. PQR Security Solutions has designed an AI Model to detect cyber attacks on E-Commerce websites. For this, various network activities were monitored and analyzed on one of the websites. The model was tested on a dataset of 1500 network activities. Out of these, the model correctly predicted that 1000 were cyber attacks. It also correctly identified that 250 were not cyber attacks. However, the model predicted that 200 were cyber attacks but actually they were not. Additionally, it predicted that 50 were not cyber attacks but they actually were. [CBSE 2026]

(A) Draw the confusion matrix based on the given scenario

(B) How many total cases are True Negative in the above scenario?

(C) Calculate Precision.

Ans:

(A)

		Prediction	
		Yes	**No**
Reality	**Yes**	1000 (TP)	50 (FN)
	No	200 (FP)	250 (TN)

(B) True Negative TN – 250

(C) TP = 1000, TN = 250, FP = 200, FN = 50

Precision = TP / (TP + FP)
= 1000 / 1200
= 0.833

Q2. An AI model has been developed to test specimens of blood/urine/cough etc. to diagnose ailments (diabetes/liver infection etc.). The model was tested on a data-set of about 630 tests and the resulting confusion matrix is as follows: [CBSE 2025]

Confusion Matrix

	Reality Yes	**Reality No**
Prediction Yes	**110**	**60**
Prediction No	**50**	**410**

(A) How many total cases are True Negative in the above scenario?

(B) Calculate Precision, Recall and F1 Score.

Ans:

(A) True Negative cases – 410
(B) Precision = TP / (TP + FP)
= 110 / (110 + 60)
= 110 / 170
= 0.647

(C) Recall = TP / (TP + FN)
= 110 / (110 + 50)
= 110 / 160
= 0.688

(D) F1 Score = 2 × (Precision × Recall) / (Precision + Recall)
= 2 × (0.647 × 0.688) / (0.647 + 0.688)
= 0.890 / 1.335
= 0.667

Q3. A sentiment analysis model was built to classify movie reviews as either 'Positive' or 'Negative'. The model was tested on a dataset of 500 reviews, resulting in the following confusion matrix: [CBSE Compt. 2025]

Confusion Matrix

	Reality Yes	**Reality No**
Predicted Yes	**300**	**40**
Predicted No	**60**	**100**

(a) How many total cases are True Positive in the above scenario ?
(b) Calculate Precision, Recall and F1-Score.

Ans:

From the confusion matrix:

- TP = 300
- FP = 40
- FN = 60
- TN = 100

(a) True Positive cases:
= 300

(b) Precision = TP / (TP + FP)
= 300 / (300 + 40)
= 300 / 340
= **0.882**

Recall = TP / (TP + FN)
= 300 / (300 + 60)
= 300 / 360
= **0.833**

F1 Score = 2 × (Precision × Recall) / (Precision + Recall)
= 2 × (0.882 × 0.833) / (0.882 + 0.833)
= 1.470 / 1.715
= **0.857**

Q4. GreenEye Technologies has developed an AI model to detect forest fires using satellite imagery and heat sensors. The model was tested on a dataset of 1200 sensor reports. The results of the evaluation were as follows:

- **The model correctly identified 800 instances as active forest fires.**
- **The model correctly identified 200 instances where there was no fire.**
- **The model gave a "False Alarm" by predicting a fire in 150 cases where there was none.**
- **The model failed to detect a fire in 50 cases where a fire was actually present.**

(A) **Identify the values for True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN)**
(B) **Calculate the Classification Accuracy of this forest fire detection model**
(C) **Calculate the Precision of the model**
(D) **In the context of forest fire detection, explain why a False Negative (FN) is considered more dangerous than a False Positive (FP)**

.Ans:

(A)

- True Positive (TP): The cases where the model correctly predicted the positive class (active fire).TP = 800.
- True Negative (TN): The cases where the model correctly predicted the negative class (no fire). TN = 200.
- False Positive (FP): The "False Alarms" where the model wrongly predicted a negative class as positive. FP = 150.
- False Negative (FN): The cases where the model wrongly predicted a positive class as negative (missed detecting a fire). FN = 50.

(B) Classification Accuracy

- Formula: (TP+TN) / (TP+TN+FP+FN)
- Calculation: (800+200) / 1200 ≈ 0.833
- Accuracy %: 0.833×100=83.3%.

(C) Precision of the Model

- Formula: TP / (TP+FP)
- Calculation: 800 / (800+150) ≈ 0.842

(D) False Negative (FN): This means a real fire is present, but the AI failed to detect it. As a result, no alert is sent, and the fire may spread uncontrollably, causing massive environmental and property damage before it is noticed.

Q5. In a sentiment analysis task, a model correctly predicts 120 positive sentiments out of 200 positive instances. However, it also incorrectly predicts 40 negative sentiments as positive. What is the F1 score of the model?

Ans: Given,

TP = 120, FP = 40, Total Actual Positive Values= 200
TP+FN = 200
So, FN = 200-TP
= 200- 120
= 80
Recall = Correct Positive Predictions /Total Actual Positive Values
= (TP)/(TP+FN)
= 120/ 200

= 0.6

Precision = Correct Positive Predictions /Total Positive Predictions
= (TP)/(TP+FP)
= 120/ (120+40)
= 120/180
= 0.75

F1 Score = 2*Precision*Recall/(Precision+Recall)
= 2*0.75*0.6/(0.75+0.6)
= 2 * 0.45/1.35
= 0.66

Q6. A multinational company, *Global-Tech*, developed an AI model to shortlist candidates for new job roles. To save time, they used an evaluation metric that they kept strictly confidential, claiming it was a "trade secret." After a year, data showed that the AI consistently rejected qualified candidates from a specific minority group, even when their scores were high. When the rejected candidates asked for an explanation, the company stated, "The algorithm made the choice based on mathematical accuracy, and we are not responsible for its individual decisions."

1. **Name the three ethical pillars that must be kept in mind while performing AI model evaluation.**
2. **Which ethical pillar was violated when the AI showed an unfair preference against a specific minority group? Explain briefly.**
3. **The company refused to explain how their evaluation metrics work. Identify the ethical pillar they failed to follow.**
4. **Define Accountability in the context of this scenario and explain why the company's response was ethically wrong.**

Ans:

1. Three Pillars: The three pillars are Bias, Transparency, and Accountability.
2. Bias: This pillar was violated because the evaluation metrics resulted in an unfair bias towards a specific group of people, leading to a disadvantage for others.
3. Transparency: By keeping their metrics a "secret," they failed to provide an honest explanation of how the chosen metrics work and produce results.
4. Accountability: Accountability means taking responsibility for the choice of metrics and methodology. The company is ethically wrong because they must take responsibility if a user faces a disadvantage due to their chosen evaluation method.

Q7. Vihaan, a Class 10 student, developed an AI model to predict the daily maximum temperature in his city. During the development process, he used a dataset of temperatures recorded in May for both training and testing his model. On a specific day, the Actual Temperature was 40°C, but his AI model predicted the temperature to be 38°C.

Vihaan was thrilled to see that when he tested the model on the May data (the same data it learned from), it achieved 100% accuracy. However, when he used the model to predict June's temperatures, the accuracy dropped significantly.

1. **Calculate the Absolute Error and the Error Rate for the day when the model predicted 38°C instead of 40°C. (1 Mark)**
2. **Calculate the Accuracy % for that specific prediction. (1 Mark)**
3. **Why did Vihaan's model show 100% accuracy during its initial test on May's data? Name the technical term for this phenomenon. (1 Mark)**
4. **Based on the AI project cycle, what should Vihaan have done differently during the evaluation stage to ensure his model was reliable for future predictions? (1 Mark)**

Ans:

1. Error Calculations:
   - Absolute Error: |Actual−Predicted|=|40−38|=2∘C.
   - Error Rate: Error / Actual = 2/40 = 0.05.

2. Accuracy Calculation:
   - Accuracy: 1−Error Rate=1−0.05=0.95.
   - Accuracy %: 0.95×100=95%.

3. The model showed 100% accuracy because it was evaluated using the same data used to build it; the model simply "remembered" the training set rather than learning patterns. This is known as Overfitting.

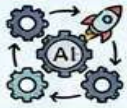
4. Vihaan should have used the Train-Test Split technique. He should have evaluated the model using a Testing Dataset—data that the model had never seen during training—to properly estimate how it would perform on new, real-world examples.

Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz link : https://forms.gle/6BuuRkcfP4piF6S56

Evaluating Models

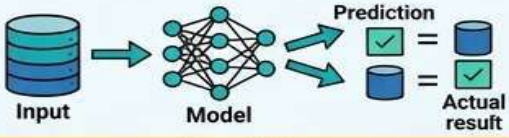
1 Model Evaluation is the 5th Stage of the AI Project Cycle



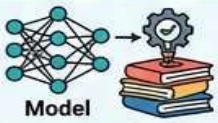
"It is the process of using **different metrics** to understand how well a machine learning model performs."

2 Training and Testing Data

The **Train-Test Split** is a technique for evaluating the performance of a machine learning algorithm. The procedure involves taking a dataset and dividing it into two subsets:

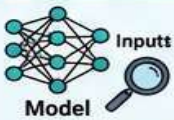


Training Dataset



The data used to help the model learn.

Testing Dataset



New data that the model has never seen before.

Overfitting

Overfitting occurs when a model memorizes the training data instead of **learning actual patterns.**

The model performs **very well** on training data. However, it performs **poorly on new or unseen data.**

This usually happens when the same data is used for both training and evaluation.

3 Accuracy and Error

⭐ **Rule:** Better model → Higher accuracy

Accuracy: Number of correct predictions made by the model.

Error: Difference between predicted value and actual value.

Goal: Maximize accuracy and minimize error.

Important Formulas

Error (Absolute): |Actual Value - Predicted Value|

Error Rate: $\frac{\text{Error}}{\text{Actual}}$

Accuracy: 1 - Error Rate

Accuracy %: Accuracy × 100%

4 Classification in AI

Classification is a type of problem where the AI predicts a specific "class" or label for an input. Examples:

Predicting if an email is "Spam" or "Not Spam," or if a person is "Infected" or "Not Infected" with a disease.

5 Classification Metrics

A. Classification Accuracy

Correct predictions out of total predictions → **(TP + TN) / Total**

⚠️ **Limitation:** Works best for balanced data

📌 **Example:** 90 normal, 10 spam → predicting all "normal" = 90% accuracy, but fails to detect spam

C. Recall

Correct positive predictions out of actual positives → **TP / (TP + FN)**

✅ Measures how many actual positives are correctly identified

🎯 **Use when:** False Negatives (FN) must be minimized

📌 **Example:** COVID-19 detection (missing a case is dangerous)

The Confusion Matrix:

A Confusion Matrix is a table used to show the performance of a classification model. It maps "Actual Values" against "Predicted".

Predicted Values \ Actual Values	Positive	Negative
Positive	True Positive	False Positive
Negative	False Negative	True Negative

B. Precision

Correct positive predictions out of predicted positives → **TP / (TP + FP)**

✅ Measures how many predicted "positive" are actually correct

🎯 **Use when:** False Positives (FP) must be minimized

📌 **Example:** Satellite launch (wrong "good" prediction is risky)

D. F1 Score

Balance between Precision and Recall

Formula: $\frac{2 * \text{Precision} * \text{Recall}}{(\text{Precision} + \text{Recall})}$

Use when: Data is unbalanced & FP vs FN importance is unclear

6 Ethical Concerns

When evaluating AI, we must keep these three things in mind:

Bias: Ensure evaluation metrics do not lead to unfair results for certain groups.

Transparency: Be honest about how the metrics were chosen and how they work.

Accountability: Take responsibility for the model's outcome and the chosen evaluation method.

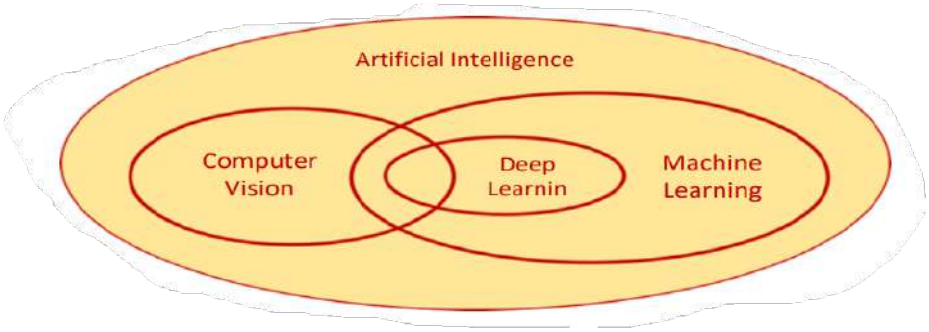
Unit 5: Computer Vision

Computer Vision (CV) is a field of **Artificial Intelligence (AI)** that helps machines **"see" and understand images or videos** just like humans do.

- It teaches computers to **analyze, recognize, and make decisions** based on visuals.
- CV uses **Machine Learning (ML)** and **Deep Learning (DL)** to understand visual data.

Computer Vision and Artificial Intelligence

- Computer Vision is a part of Artificial Intelligence (AI).
- It helps machines understand images and videos.
- AI makes machines think, while Computer Vision helps them see and interpret visuals.



Why is it important?

- Automates tasks that need **human eyes** (e.g., identifying faces or objects).
- Helps in areas like **self-driving cars, facial recognition, healthcare**, and **security systems**.

Difference Between Computer Vision and Image Processing

Computer Vision	Image Processing
Focuses on interpreting images or videos to extract meaningful data and make predictions.	Focuses on enhancing or transforming images for further analysis.
Encompasses image processing as part of its workflow.	A component of computer vision tasks.
Examples: Object detection, face recognition, handwriting reading.	Examples: Resizing, adjusting brightness, filtering colors.

Applications of Computer Vision

Here are real-life uses of Computer Vision:

1. **Facial Recognition**
   Used in **phones and security systems** to recognize faces.
   Example: Face ID in iPhones.
2. **Self-Driving Cars**
   Detects roads, people, and signs to drive safely.
   Example: Tesla's Autopilot.
3. **Medical Imaging**
   Analyzes scans like X-rays and MRIs to detect diseases.
   Example: AI finds tumors faster than doctors.
4. **Retail Industry**
   Tracks customers and stock using cameras.
   Example: Amazon Go stores with no cashier.
5. **Google Translate Camera**
   Translates text from photos using OCR (Optical Character Recognition).
   Example: Translating a menu from Chinese to English.

Key Tasks in Computer Vision

Here are the main things **Computer Vision** can do with images:

- **Image Classification** – Tells what the object in the image is (e.g., cat or dog).
- **Localization** – Tells where the object is inside the image.
- **Object Detection** – Finds **multiple objects** in one image.
- **Instance Segmentation** – Separates and labels **every part** of an object in the image.

Example: A self-driving car detects people, vehicles, and traffic signs around it.

Understanding Images & Pixels

- **Pixel (Picture Element)** is the **smallest unit** of an image.
- Each pixel holds **color and brightness**.
- More pixels = **higher resolution** and better image clarity.

Types of Images:

- **Grayscale Images** – Only **black, white, and gray** (0 to 255).
- **RGB Images** – Uses **Red, Green, and Blue** colors.

Examples:

- Black = (0, 0, 0)
- White = (255, 255, 255)
- Red = (255, 0, 0)

Image Features

AI looks for special visual patterns:

- **Edges** – Sharp color changes (useful for object shapes).
- **Corners** – Meeting points of edges (used in 3D detection).
- **Blobs** – Similar color areas (used in medical scans).

Example: Detecting edges of car number plates using CV.

Introduction to OpenCV

OpenCV stands for **Open-Source Computer Vision**. It's a **Python library** that helps in:

- Reading and changing images.
- Doing tasks like face detection and noise removal.

Installing OpenCV:

pip install opencv-python

Common OpenCV functions:

- cv2.imread() – Load an image.
- cv2.imshow() – Show the image.
- cv2.cvtColor() – Change image colors (e.g., to grayscale).

What is Convolution?

Convolution is a method to change an image by using a small matrix called a **kernel**.

A **kernel** moves over the image and changes pixel values to:

- Detect **edges**
- **Blur** or **sharpen** the image
- Remove **noise**

Example: In CCTV, convolution helps sharpen blurry images.

9. <u>What are CNNs (Convolutional Neural Networks)?</u>

CNNs are **deep learning models** specially made for analyzing images.

Layers in CNN:

1. **Convolution Layer** – Finds patterns like edges and textures.
2. **ReLU((Rectified Linear Unit) Layer** – Adds non-linearity to make learning better.
3. **Pooling Layer** – Shrinks the image while keeping the main parts.
4. **Fully Connected Layer** – Makes the final prediction.

Example: Instagram uses CNNs to detect your face for filters.

Pooling Layer

Reduces the image size to:

- Make processing **faster**
- Use **less memory**

Types:

- **Max Pooling** – Takes the largest value (best for feature selection).
- **Average Pooling** – Takes the average value.

Example: Compressing satellite images but keeping key features.

Fully Connected Layer

This is the **final step** in CNN.

- Uses all features from the image to **predict the result**.
- Outputs a **class label** (e.g., Cat or Dog).

Example: AI detects whether an X-ray shows a healthy or diseased lung.

Objective Questions on Computer Vision

1. What is the full form of CNN in the context of Computer Vision?
a) Convolutional Neural Network
b) Computer Network Node
c) Central Neural Network
d) Convoluted Network Node

2. Which of these is a key function of Computer Vision?
a) Text-to-speech conversion
b) Image recognition
c) Data compression
d) Speech processing

3. What is a pixel in an image?
a) Brightness tool
b) A unit of image storage
c) The smallest unit of an image
d) An image filter

4. Which model is commonly used for color representation in digital images?
a) CMYK b) RGB c) HSV d) RYB

5. What is the main use of the pooling layer in a CNN?
a) To enlarge the image
b) To reduce processing complexity
c) To convert image format
d) To sharpen image

6. Which of these is an application area of Computer Vision?
a) Facial recognition b) Audio mixing
c) Sound detection d) Text translation

7. What does edge detection help achieve in image processing?
a) Blur the background
b) Find object outlines
c) Add shadow effects
d) Remove image noise

8. What does resolution in an image typically indicate?
a) Number of bits
b) Number of colors
c) Width × Height in pixels
d) Color range of pixels

9. Which range represents grayscale image pixel values?
a) 1 to 128 b) 0 to 255
c) 0 to 1000 d) 1 to 256

10. What is object detection in the context of CV?
a) Changing image colors
b) Compressing images
c) Finding objects within an image
d) Saving an image

11. Which layer in a CNN is responsible for learning key features?
a) Output layer b) Pooling layer
c) Convolutional layer d) Input layer

12. Which of the following is not a Computer Vision task?
a) Object detection b) Image segmentation
c) Voice modulation d) Image classification

13. What is the core idea behind image classification?
a) Locate object boundaries
b) Assign category to image
c) Convert to grayscale
d) Measure image resolution

14. What is the role of the ReLU layer in CNN?
a) Adds shadows
b) Removes negative values
c) Enlarges feature map
d) Rotates images

15. Object detection and handwriting recognition are examples of:

a) Sound processing b) Image copression

c) Computer Vision tasks d) Data entry

16. What does the pixel value indicate in a grayscale image?
a) The pixel size b) Color depth
c) Brightness level d) Image height

17. In an RGB image, what does a pixel with all values 0 represent?
a) Maximum brightness b) Full saturation
c) Complete darkness d) Grayscale tone

18. Assertion: Object detection is more complex than image classification.
Reason: It involves identifying the object's type and its position in the image.
a) Both A and R are true; R explains A
b) Both A and R are true; R doesn't explain A
c) A is true; R is false
d) A is false; R is true

19. Assertion: Grayscale images consist of varying shades of gray and use one byte per pixel.
Reason: Each pixel in grayscale has three intensity values ranging from 0 to 255.
a) Both A and R are true; R explains A
b) Both A and R are true; R doesn't explain A
c) A is true; R is false
d) A is false; R is true

20. What is the main goal of using CNNs in Computer Vision?
a) Text formatting

b) Image encryption

c) Pattern detection in visuals
d) File conversion

21. In the context of Artificial Intelligence, how does the Handbook distinguish between Computer Vision and Image Processing?

a) Computer Vision only deals with video data, while Image Processing only deals with static text and photos.

b) Image Processing is a more advanced version of Artificial Intelligence that replaces Computer Vision.

c) Image Processing is used to predict visual input, while Computer Vision only enhances raw images.

d) Computer Vision is a superset that extracts meaningful information, whereas Image Processing is a subset focused on preparing or enhancing raw images.

22. Which specific Computer Vision task involves identifying the presence of a single object and its exact location within an image?

a) Classification + Localisation
b) Instance Segmentation
c) Classification
d) Object Detection

23. Why is the maximum value for a pixel in a common byte image format 255?

a) It is the highest prime number below 300.

b) It represents the 25.5 percent of light reflected by a standard gray card.

c) It matches the 255 shades of gray visible to the human eye.

d) Each pixel uses 1 byte (8 bits), and provides 256 possible values starting from 0.

24. **Google's Teachable Machine is described as a tool that can train models based on which three types of inputs?**

a) GPS Data, Temperature, and Wind Speed

b) Text, Numbers, and Spreadsheets

c) Handwriting, Fingerprints, and Eye Scans

d) Images, Audio, and Poses

25. Which application of Computer Vision uses 'Optical Character Recognition' (OCR) combined with 'Augmented Reality' (AR)?

a) Self-Driving Cars

b) Retail Inventory Management

c) Instagram Face Filters

d) Google Translate App

26. What is a 'Kernel' in the context of image processing?

a) The first pixel in the top-left corner of any digital image.

b) A small matrix slid across an image to apply effects or extract features.

c) The physical lens of the camera used to capture the data.

d) The central processor of the computer that runs the AI software.

27. The car's system detects a stop sign, a pedestrian, and a cyclist simultaneously in one frame and draws bounding boxes around each. Which computer vision task does this represent?

a) Image Classification
b) Classification + Localisation
c) Object Detection
d) Feature Extraction

28. Assertion (A): Image processing is a superset of computer vision.

Reason (R) : Computer vision involves extracting and understanding information from images to make predictions, which goes beyond the scope of image processing that only enhances or prepares images.

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

29. Assertion (A): Object detection can identify multiple objects and their locations in a single image.

Reason (R) : Object detection algorithms extract features and apply learning algorithms to recognise instances of multiple object categories and determine their spatial locations simultaneously.

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

30. Assertion (A): A grayscale image of size 200×300 pixels occupies 60,000 bytes of storage.

Reason (R): Each pixel in a grayscale image is stored as a single byte (8 bits) with values from 0 to 255, so total bytes = Height × Width × 1.

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

Answer Key

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
a	b	c	b	b	a	b	c	b	c
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
c	c	b	b	c	c	c	a	c	c
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
d	a	d	d	d	b	c	d	a	a

Short Answer Questions (1 Mark / 2 Mark) on Computer Vision

1. Define Computer Vision and provide one real-life application.

Answer: Computer Vision is a field of Artificial Intelligence that enables machines to interpret and process visual information from the world, such as images and videos. A real-life application is facial recognition used in smartphone security systems.

2. What is the role of pixels in digital images?

Answer: Pixels, short for "picture elements," are the smallest units of a digital image. Each pixel represents a single point in the image and has its own color and intensity value, contributing to the overall picture.

3. Explain the difference between grayscale and RGB images.

Answer: Grayscale images consist of shades of gray, with pixel values ranging from 0 (black) to 255 (white). RGB images use three color channels—Red, Green, and Blue—each ranging from 0 to 255, to create a full spectrum of colors.

4. What is the purpose of the pooling layer in Convolutional Neural Networks (CNNs)?

Answer: The pooling layer reduces the spatial dimensions of the feature maps, which decreases computational load and helps in extracting dominant features that are rotational and positional invariant.

5. Name two Python functions from the OpenCV library used in image processing.

Answer: Two commonly used OpenCV functions are cv2.imread() for reading images and cv2.imshow() for displaying images.

6. Describe one application of Computer Vision in the healthcare industry.

Answer: In healthcare, Computer Vision is used in medical imaging to detect anomalies such as tumors in X-rays or MRI scans, aiding in early diagnosis and treatment planning.

7. What is edge detection in image processing, and why is it important?

Answer: Edge detection is a technique used to identify the boundaries within images. It is crucial for object detection and recognition, as it highlights significant transitions in pixel intensity.

8. How does Computer Vision contribute to autonomous vehicles?

Answer: Computer Vision enables autonomous vehicles to interpret visual data from their surroundings, such as recognizing traffic signs, detecting pedestrians, and identifying other vehicles, which is essential for safe navigation.

9. What is the function of the cv2.cvtColor() method in OpenCV?

Answer: The cv2.cvtColor() function is used to convert images from one color space to another, such as converting a color image to grayscale.

10. Explain the term 'object detection' in the context of Computer Vision.

Answer: Object detection refers to the process of identifying and locating objects within an image or video. It involves classifying objects and determining their positions, often using bounding boxes.

11. Describe how image classification, classification with localization, object detection, and instance segmentation differ in computer vision. Support your explanation with suitable examples for each.

Answer.

Task	Description	Example
Image Classification	Predicts the main object or scene in the entire image.	A photo is classified as "cat".
Classification with Localization	Predicts the object class and its location (bounding box).	Identifying a "dog" and drawing a box around it.
Object Detection	Detects multiple objects with their classes and bounding boxes.	Detecting cars, people, and bikes in a street image.
Instance Segmentation	Detects, classifies, and precisely outlines each object at the pixel level.	Separating and labeling each person in a crowd.

12: A startup is building a mobile app that lets users take a photo of any plant and instantly identifies the species.

Which computer vision task is being used, and why is it suitable here?

Answer: This is an Image Classification task — the app assigns one label (species name) from a fixed set of plant categories to each input image. It is suitable because only a single object (the plant) occupies the image and a single categorical label is needed.

13: A traffic management system must detect every vehicle on a multi-lane highway and mark each one with a bounding box in real time.

Identify the computer vision task used and explain its advantage over simple classification.

Answer: This is Object Detection, which identifies multiple objects (vehicles) and localises each with bounding boxes. Unlike classification, which gives only a label for the whole image, object detection handles multiple instances and provides their spatial positions simultaneously.

14: A medical imaging platform converts 2D X-ray scans into 3D models. A radiologist notices the system also correctly outlines each individual tumour's pixel boundary.

Which computer vision task produces pixel-level outlines of individual instances? How is it different from object detection?

Answer: Instance Segmentation produces pixel-level masks for each individual object instance. Unlike Object Detection (which only draws bounding boxes), Instance Segmentation delineates the exact pixel shape of each object, enabling more precise analysis like tumour volume measurement.

15: Two images of the same road are taken: one at noon (bright) and one at midnight (dark). The pixel values differ significantly.

Explain why pixel values differ between these two images and what range they fall in.

Answer: Pixel values represent the brightness and colour of each pixel, stored as integers from 0 (black/no light) to 255 (white/full brightness). The noon image has higher pixel values (brighter) while the midnight image has lower values (darker), because available light directly affects the intensity captured by the camera sensor.

16: A student takes a selfie with 12 megapixels. Another student takes one at 2 megapixels.

Which image will look clearer when zoomed in, and why?

Answer: The 12 megapixel image will look clearer because it contains significantly more pixels (approximately 12 million vs. 2 million). More pixels mean finer detail is captured; when zoomed, the image still closely approximates the original scene without appearing blocky or pixelated.

17: A grayscale scan image of a chest X-ray is 512×512 pixels.

How many bytes of data does this image contain? Show your working.

Answer: Storage = Height × Width × Bytes per pixel = 512 × 512 × 1 = 262,144 bytes. Since grayscale images use one byte (8 bits) per pixel to store intensity values from 0–255, the total is 262,144 bytes (approximately 256 KB).

18: An Instagram filter instantly places digital bunny ears exactly on a user's head.

Which computer vision tasks are likely combined in this feature? Briefly explain each.

Answer: The feature combines Classification (identifying that a face is present), Localisation (finding where the face/head is in the frame), and Landmark Detection (mapping specific facial points like the top of the head). Together, these allow accurate, real-time positioning of the overlay.

19: A developer applying a convolution kernel of all positive values to an image observes that the output image becomes brighter overall.

Explain why using all positive kernel values produces this effect.

Answer: In convolution, the kernel values are multiplied element-wise with pixel values and summed. When all kernel values are positive, they amplify the underlying pixel intensities. The summation yields larger output values, which correspond to brighter pixel results in the output feature map.

20: A CNN processes a chest scan. After the convolutional layer produces a feature map, the values range from −50 to +200.

What does the ReLU layer do to these values, and why is this step important?

Answer: ReLU replaces all negative values with 0, keeping positive values unchanged. So values like −50 become 0, while 200 stays 200. This introduces non-linearity into the network, making boundary features sharper and colour transitions more abrupt, which helps deeper layers detect complex patterns.

21: A 4×4 feature map after convolution undergoes 2×2 Max Pooling with stride 2.

What is the size of the output, and what is the purpose of this pooling operation?

Answer: The output is 2×2. With a 2×2 kernel and stride 2, each non-overlapping 2×2 block of the 4×4 map is reduced to its maximum value. Max Pooling reduces spatial dimensions, making computation more efficient and making the model more robust to small shifts or distortions in the input.

22: A security system uses a CNN. The system output is: 'Authorised – 92%, Intruder – 6%, Unknown – 2%'.

Which layer produces these probability scores, and how does it generate them?

Answer: The Fully Connected (FC) Layer produces these probability scores. It flattens the pooled feature maps into a 1D vector, where each value represents the probability of belonging to a particular class. A Softmax activation function is typically applied to ensure all probabilities sum to 1.

23: A student applies a convolution kernel to maintain the output image at the same size as the input.

What technique does the student apply, and how does it work?

Answer: The student applies zero-padding. This extends the edges of the original image by adding rows and columns of zeros around the border. When the kernel overlaps with these padded edges, the output image retains the same dimensions as the input because the edge pixels are now properly convolved.

24: An RGB photo of a parrot is split into its three channels and stored separately in memory. Describe what each individual channel image looks like and why.

Answer: Each channel image appears as a grayscale image. The pixel values in the Red channel represent the intensity of red in each pixel (0=no red, 255=full red), and similarly for Green and Blue channels. They look grayscale because each channel stores only one value per pixel (intensity), not a colour combination.

25: A self-driving car company notices their model misclassifies pedestrians as cyclists under poor lighting.

Suggest two specific improvements to the computer vision pipeline to address this issue.

Answer: First, augment the training dataset with more low-light images of pedestrians and cyclists to reduce the lighting bias. Second, apply image preprocessing (e.g., contrast enhancement or adaptive histogram equalisation) to normalise pixel values before feeding images to the CNN, ensuring consistent feature extraction regardless of lighting conditions.

26: A factory uses a computer vision system to detect defective products on a conveyor belt.

Which computer vision task is most appropriate, and what kind of output would the system produce?

Answer: Object Detection is most appropriate. The system would output bounding boxes around each detected defective item along with a class label (e.g., 'Defect – Scratch', 'Defect – Dent') and a confidence score. This allows the factory to identify and locate defects simultaneously, enabling automated rejection of faulty products.

27: A batch of 1000 coral images is processed by an Orange Data Mining model. Some images are mislabelled in the training set.

Explain how mislabelled training data affects the performance of a classification model.

Answer: Mislabelled data introduces noise into the training process — the model learns incorrect associations between features and labels. This reduces accuracy on both training and test datasets. It may also create systematic errors where the model consistently misclassifies one category as another, reducing reliability for critical applications like coral monitoring.

28: A drone captures farmland images at 5 megapixels. The team wishes to understand why the CNN is slow to process each image.

Explain two reasons why high-resolution images slow down CNN processing.

Answer: First, more pixels mean a larger input array, requiring more convolution operations across the image, increasing computation time. Second, larger feature maps are produced at each convolutional layer, requiring more memory and floating-point operations during training and inference, significantly slowing down the pipeline.

29: Two computer vision researchers debate: one says 'brightness correction is computer vision', the other says 'it's only image processing'.

Who is correct, and how would you explain the distinction between the two fields?

Answer: The second researcher is correct. Brightness correction is Image Processing — it enhances or transforms raw images without extracting meaningful information or making predictions. Computer Vision goes further, using processed images to infer understanding, classify objects, and make decisions. Image Processing is a subset of Computer Vision.

30: The Emoji Scavenger Hunt game asks users to find real-world objects matching emojis within a time limit using their camera.

What role does computer vision play in this game, and which sub-tasks are likely involved?

Answer: Computer Vision enables the game to recognise real-world objects through the phone camera in real time. The sub-tasks involved include Feature Extraction (identifying key visual patterns), Image Classification (matching the captured object to a known category/emoji label), and possibly Object Detection (locating the object within the camera frame).

31: A researcher explains that a convolution kernel with large positive values at the centre and negative values around it enhances the centre of objects.

Explain how the positioning of positive and negative values in a kernel affects the convolution output.

Answer: Positive kernel values amplify the pixel intensities they multiply — regions under positive kernel positions appear brighter in the output. Negative values suppress or invert nearby pixel intensities. A kernel with a positive centre and negative surroundings subtracts the surrounding context from the central pixel, effectively sharpening or highlighting central features and detecting edges.

32: A school uses a facial recognition system for automated attendance. The system verifies each student's face against a stored database.

Identify the computer vision tasks involved and describe one ethical concern with this application.

Answer: The system uses Face Detection (locating the face in the image), Feature Extraction (mapping facial landmarks), and Image Classification/Recognition (matching against stored profiles). An ethical concern is privacy: continuous biometric monitoring of students raises issues of consent, data security, and potential misuse of sensitive personal biometric information.

33: A computer vision model is tested on an image of a cat sitting next to a dog. The model correctly draws individual boundary masks around each animal. What task is the model performing? How does it differ from simply detecting the two animals?

Answer: The model is performing Instance Segmentation. Unlike Object Detection, which draws rectangular bounding boxes, Instance Segmentation delineates each object's exact pixel-level boundary. It also distinguishes between two instances of the same or different classes individually, enabling more precise spatial understanding of each object's shape.

34: A student applies a 3×3 convolution kernel to an 8×8 image without zero-padding.

What will be the size of the output feature map? Explain why it is smaller than the input.

Answer: The output is $(8-3+1) \times (8-3+1) = 6\times6$. It is smaller because the kernel cannot be centred on edge pixels without going outside the image boundary; thus, it only slides within valid positions. The output loses one pixel on each side, reducing dimensions by (kernel size − 1) in each direction.

35: Lobe.ai is described as an Auto-ML (no-code AI) tool for image classification.

Question: What does 'Auto-ML' mean in this context, and what advantage does it offer non-technical users?

Answer: Auto-ML (Automated Machine Learning) automatically selects, trains, and optimises the best model for the task based on the labelled data provided. For non-technical users, it eliminates the need to understand neural network architectures, hyperparameter tuning, or coding — they simply provide labelled images and the tool handles the rest.

36: An online fashion retailer wants to let customers search for products by uploading a photo (similar to Google's Search by Image). Explain how computer vision enables this image-based search feature.

Answer: The system uses Computer Vision to extract visual features (colour, texture, shape, patterns) from the uploaded image using a CNN. These features are compared against a database of product image features using similarity metrics. The closest matching products are returned as search results, making the comparison image-based rather than text-based.

37: A pooled feature map of a city image is produced after Max Pooling. The original feature map was 8×8; after pooling with a 2×2 kernel and stride 2, it becomes 4×4. Explain what information is retained and what is lost during this pooling operation.

Answer: Max Pooling retains the most dominant (highest) activation value in each 2×2 region, preserving the most significant features while reducing spatial dimensions. What is 'lost' is the precise location of weaker activations within each region. However, the dominant features that matter most for classification remain well-represented in the smaller map.

38: A CNN model for identifying bird species fails to recognise a familiar species when the bird is photographed from behind instead of from the front. What limitation of the model does this reveal, and how could the training process address it?

Answer: This reveals the model's lack of viewpoint invariance — it has likely been trained predominantly on front-facing bird images and lacks diverse perspectives. The training process should be improved by including images from multiple angles and orientations for each species (data augmentation), enabling the model to learn viewpoint-independent features.

39: Agricultural drones help detect crop diseases by analysing aerial images. A computer vision researcher points out that 'indicators such as leaf colour and texture' are key parameters. How does a CNN learn to detect colour and texture-based disease indicators from training images?

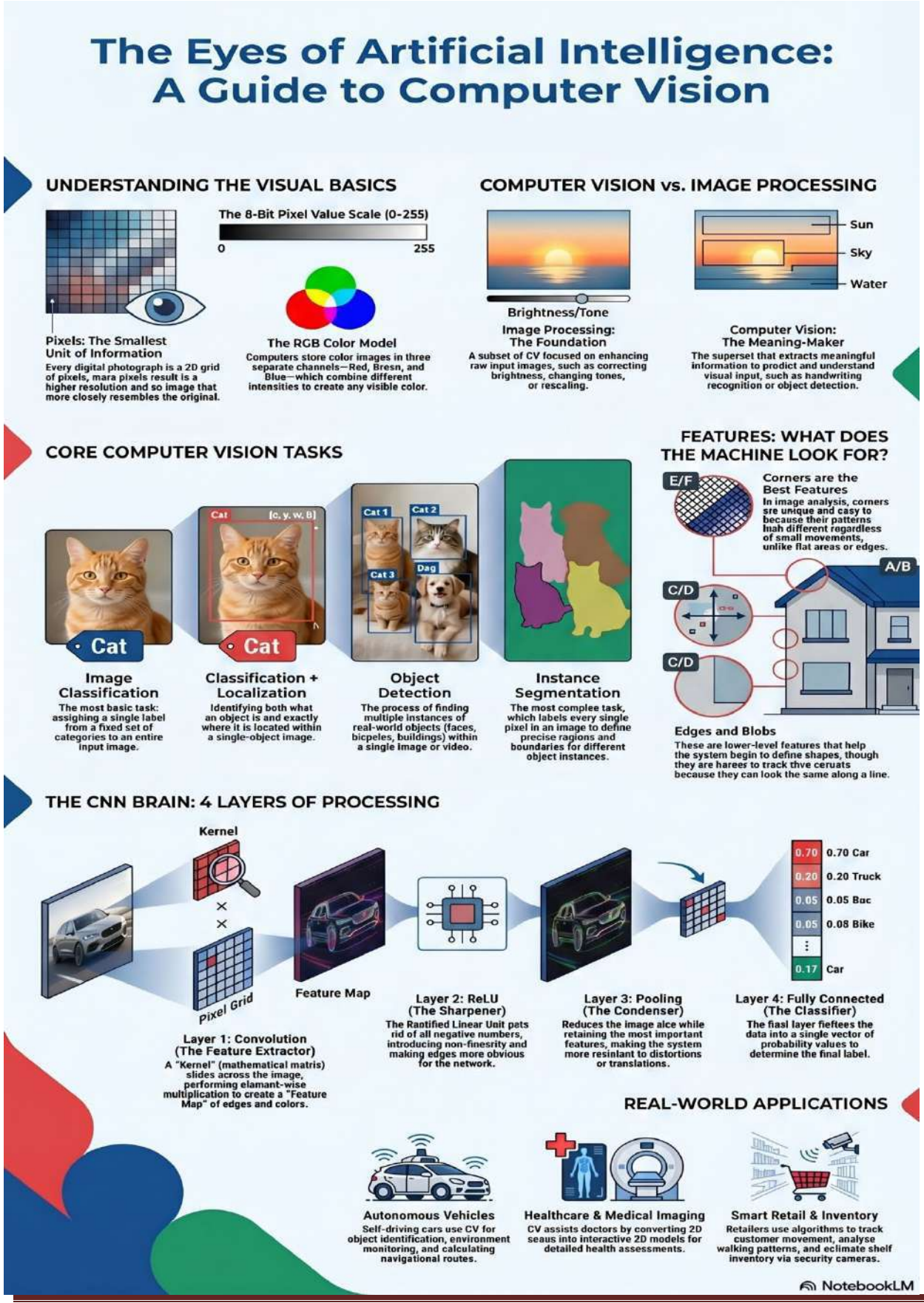
Answer: In the convolutional layers, kernels learn to detect colour gradients and texture patterns (repetitive structures, roughness) by optimising their weights during training. Early layers capture basic features like colour blobs and edges; deeper layers combine these into complex patterns associated with disease signatures. The model learns that specific colour shifts (e.g., yellowing) and abnormal textures predict disease through labelled training examples.

40: A team of students summarises their understanding of CNN: 'The CNN takes an image, extracts features through convolution and pooling, removes negative values, and finally classifies it.' Using the four layers of a CNN, explain the correct sequence of processing an image and the role of each layer.

Answer: 1) Convolutional Layer: applies kernels to extract features (edges, textures) producing a feature map. 2) ReLU Layer: removes negative values to introduce non-linearity, sharpening feature distinctions. 3) Pooling Layer: reduces feature map size using Max or Average pooling, retaining dominant features and adding spatial robustness. 4) Fully Connected Layer: flattens the pooled maps into a vector and outputs probability scores for each class label, enabling final classification.

Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz Link : https://forms.gle/hGo9fSmdVc7jLdTYA


The Eyes of Artificial Intelligence: A Guide to Computer Vision
UNDERSTANDING THE VISUAL BASICS
The 8-Bit Pixel Value Scale (0-255)
0
255
Pixels: The Smallest Unit of Information
Every digital photograph is a 2D grid of pixels, mara pixels result is a higher resolution and so image that more closely resembles the original.
The RGB Color Model
Computers store color images in three separate channels—Red, Bresn, and Blue—which combine different intensities to create any visible color.
COMPUTER VISION vs. IMAGE PROCESSING
Brightness/Tone
Image Processing: The Foundation
A subset of CV focused on enhancing raw input images, such as correcting brightness, changing tones, or rescaling.
Sun
Sky
Water
Computer Vision: The Meaning-Maker
The superset that extracts meaningful information to predict and understand visual input, such as handwriting recognition or object detection.
CORE COMPUTER VISION TASKS
Cat
Cat
[c, y, w, B]
Cat 1
Cat 2
Cat 3
Dag
Image Classification
The most basic task: assighing a single label from a fixed set of categories to an entire input image.
Classification + Localization
Identifying both what an object is and exactly where it is located within a single-object image.
Object Detection
The process of finding multiple instances of real-world objects (faces, bicpeles, buildings) within a single image or video.
Instance Segmentation
The most complee task, which labels every single pixel in an image to define precise ragions and boundaries for different object instances.
FEATURES: WHAT DOES THE MACHINE LOOK FOR?
E/F
Corners are the Best Features
In image analysis, corners sre unique and easy to because their patterns lnah different regardless of small movements, unlike flat areas or edges.
A/B
C/D
C/D
Edges and Blobs
These are lower-level features that help the system begin to define shapes, though they are harees to track thve ceruats because they can look the same along a line.
THE CNN BRAIN: 4 LAYERS OF PROCESSING
Kernel
Pixel Grid
Feature Map
Layer 1: Convolution (The Feature Extractor)
A "Kernel" (mathematical matris) slides across the image, performing elamant-wise multiplication to create a "Feature Map" of edges and colors.
Layer 2: ReLU (The Sharpener)
The Rantified Linear Unit pats rid of all negative numbers, introducing non-finesrity and making edges more obvious for the network.
Layer 3: Pooling (The Condenser)
Reduces the image alce while retaining the most important features, making the system more resinlant to distortions or translations.
0.70 0.70 Car
0.20 0.20 Truck
0.05 0.05 Bac
0.05 0.08 Bike
0.17 Car
Layer 4: Fully Connected (The Classifier)
The fiasl layer fieftees the data into a single vector of probability values to determine the final label.
REAL-WORLD APPLICATIONS
Autonomous Vehicles
Self-driving cars use CV for object identification, environment monitoring, and calculating navigational routes.
Healthcare & Medical Imaging
CV assists doctors by converting 2D seaus into interactive 2D models for detailed health assessments.
Smart Retail & Inventory
Retailers use algorithms to track customer movement, analyse walking patterns, and eclimate shelf inventory via security cameras.
NotebookLM

UNIT 6 - NATURAL LANGUAGE PROCESSING

Natural Language

- Natural language is the language used by humans for communication.
- Examples include English, Hindi, French, and Japanese.

Features of Natural Language

- Natural language follows rules like syntax, lexicon, and semantics.
- The same information can be expressed in multiple ways.
- Natural languages change over time.
- Words can have different meanings depending on context.

Example

Sentence	Meaning of "Red"
His face turned red after he took the wrong bag.	Feeling ashamed or embarrassed
The red car zoomed past.	Colour of the car
His face turned red after taking medicine.	Possible reaction or illness

Computer Language and NLP

- Computer languages are used to communicate with computers.
- Examples include Python, C++, Java, and HTML.
- Computers understand only binary language (0s and 1s).
- NLP helps convert human language into a form that computers can understand.
- NLP enables communication between humans and machines.

Natural Language Processing

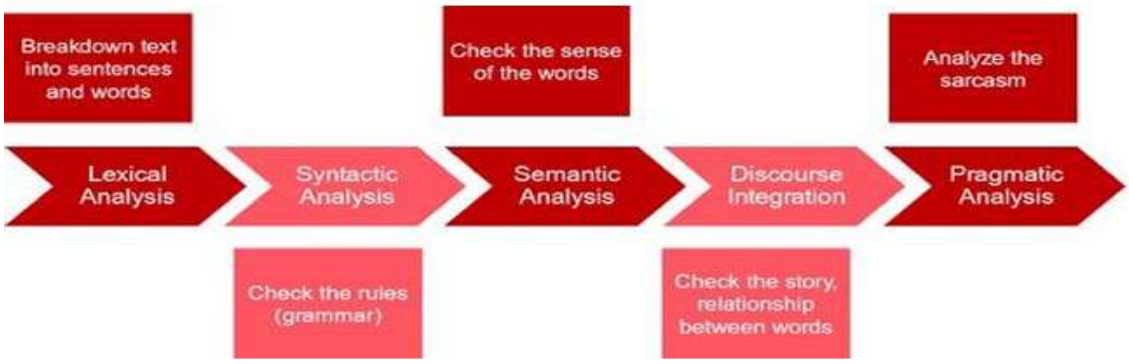
Natural Language Processing (NLP) is a branch of Artificial Intelligence that helps computers understand, interpret, process, and respond to human language.

- NLP helps computers analyse and understand human language.
- NLP helps extract meaningful information from text or speech

Applications of NLP

- **Voice Assistants:** These systems understand voice commands and respond intelligently. E.g. Siri, Alexa, and Google Assistant.
- **Auto-generated Captions:** Real-time speech-to-text conversion for videos and meetings. E.g. YouTube videos, Online meetings, Live broadcasts etc.
- **Language Translation:** Translating text from one language to another while maintaining meaning (e.g., Google Translate).
- **Sentiment Analysis:** Identifying the emotional tone behind a piece of text (Positive, Negative, or Neutral) e.g. Used in Product reviews, social media analysis etc
- **Text Classification:** Automatically sorting text into categories, such as Email Spam filters, News categorization
- **Keyword Extraction:** Identifying the most important words or phrases in a document. Eg. News articles, Online Shopping Reviews etc. E-commerce websites use keyword extraction to:
    - Analyze customer reviews
    - Identify product strengths
    - Recommend products

Stages of Natural Language Processing



1. Lexical Analysis

- Lexical analysis breaks text into paragraphs, sentences, and words.
- It helps identify the structure of input text.
- Lexicon - collection of the various words and phrases used in a language.

  Example: "AI changes education."

AI	Changes	education

2. Syntactic Analysis

- Syntactic analysis checks the grammar of sentences.
- It ensures that the sentence structure is correct.

Example: "Student the notes writes." Wrong
"The student writes notes." Right

3. Semantic Analysis

- Semantic analysis checks the meaning of words and sentences.
- It removes sentences that do not make sense.

Example: "The quick brown jumped fox over the lazy dog": Wrong
"The quick brown fox jumped over the lazy dog: Right

4. Discourse Integration

- Discourse integration connects sentences logically.
- It ensures that the flow of ideas is correct.
- Every sentence should have a relationship with its preceding and succeeding sentences.

Example:
Riya went to the library.
She borrowed a science book.
The NLP system understands that: "She" refers to Riya.

5. Pragmatic Analysis

- In this stage, sentences are checked for their relevance in the real world.
- Pragmatic analysis understands the intended meaning of a sentence.
- It considers real-world knowledge and context.

Example:
Relax! I'm just pulling your leg."
This sentence means the person is joking.
It does not mean he is actually pulling someone's leg.

Chatbot

- A chatbot is a computer program that simulates human conversation.
- It can communicate through **text or voice**.
- It uses NLP to understand user input.
- It responds like a human in conversations.

Examples: Eliza, Mitsuku, Cleverbot, Singtel

There are two types of chatbot: **Script bot and Smart bot**

Script Bot	Smart Bot
Script bots are easy to make.	Smart bots require coding to develop.
Script bots work on pre-defined scripts.	Smart bots work on larger databases and resources.
They are mostly free and easy to integrate with messaging platforms.	They require more resources and setup.

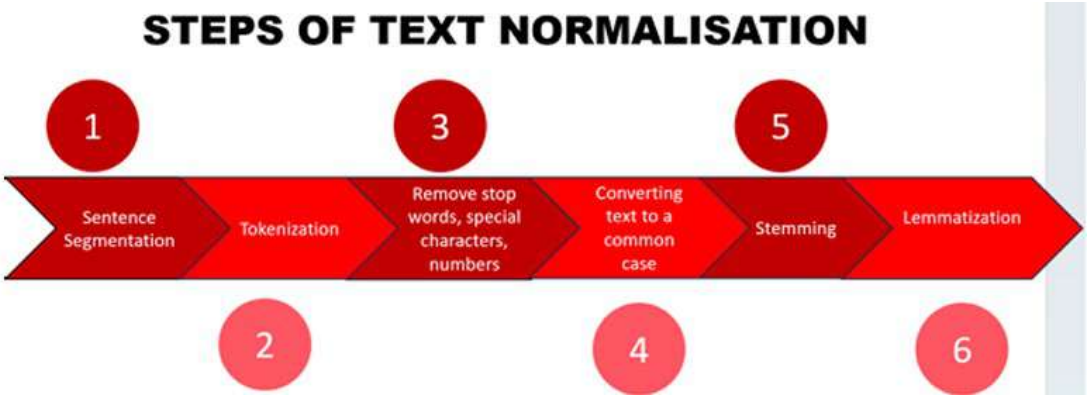
They have no or very little language processing ability.	They use NLP and learn from data.
They do not learn from interactions.	They learn with more data over time.
They have limited functionality.	They have wide and advanced functionality.
They are less flexible.	They are flexible and powerful.
Eg: Bank IVR Systems, Basic website FAQ bots	Eg: ChatGPT

Text Processing

- Computers cannot easily understand human language.
- NLP helps machines understand and process human language.
- However, computers can only understand numerical data.
- Therefore, human language must be converted into numbers.
- This conversion begins with text normalisation, which simplifies the text for better processing.

Text Normalisation

- Text normalisation is the process of cleaning and simplifying text.
- It reduces the complexity of human language.



What is Corpus?

- A corpus is a collection of text documents.
- It contains all the text data used for processing.

Steps of Text Normalisation

1. Sentence Segmentation

- Sentence segmentation divides the corpus into sentences.
- Each sentence is treated as a separate unit.

2. Tokenization

- Tokenization divides sentences into smaller units called tokens.
- Tokens include words, numbers, and special characters.

Example:

Sentence	Tokens
Aman went to school	aman, went, to, school

3. Removing Stop Words

- Stop words are frequently used words with little meaning.
- Examples include: the, is, are, and, to.
- These words are removed to focus on important words.

Example:

Before	After
Aman is going to school	aman, going, school

4. Removing Special Characters and Numbers

- Special characters and numbers may be removed if not needed.
- This depends on the type of text data.

5. Converting to Lowercase

- All words are converted into lowercase.
- This ensures that the case sensitivity of the machine does not consider the same words as different just because of different cases.

Example:

Before	After
Hello, HELLO, hello	hello, hello, hello

6. Stemming

- Stemming reduces words to their root form.
- The root word may not always be meaningful.
- It removes suffixes quickly.

Example:

Word	Stem
healed	heal
healing	heal
studies	studi

7. Lemmatization

- Lemmatization reduces words to meaningful root forms.

- The output word is called a lemma.
- It is slower but more accurate than stemming.

Example:

Word	Lemma
healed	heal
studies	study
studying	study

Difference Between Stemming and Lemmatization

Stemming	Lemmatization
May give meaningless words	Gives meaningful words
Faster process	Slower process
Simple rule-based	Uses vocabulary and meaning
Caring → Car	Caring → Care

Bag of Words

Bag of Words is a Natural Language Processing model which helps in extracting features out of the text which can be helpful in machine learning algorithms.

Bag of words gives us two things:
1. A vocabulary of words for the corpus
2. The frequency of these words (number of times it has occurred in the whole corpus).

The step-by-step approach to implementing the bag of words algorithm:

Step 1: Text Processing (Collect and Pre-process Data)
- In this step, we collect the text documents.
- We perform basic text processing like tokenization.
- Each document is converted into a list of words.

Given Documents

Document	Sentence
Document 1	Aman and Avni are stressed
Document 2	Aman went to a therapist
Document 3	Avni went to download a health chatbot

Step 2: Create a Dictionary (Vocabulary)

- In this step, we create a list of all unique words.
- Each word is written only once even if it appears multiple times.
- This list is called the vocabulary.

Vocabulary

aman, and, avni, are, stressed, went, to, a, therapist, download, health, chatbot

Step 3: Create Document Vector

In this step, we compare each document with the vocabulary.

- If a word is present, we write **1**.
- If a word is absent, we write **0**.
- If a word appears more than once, we increase the value.

Document 1 Vector

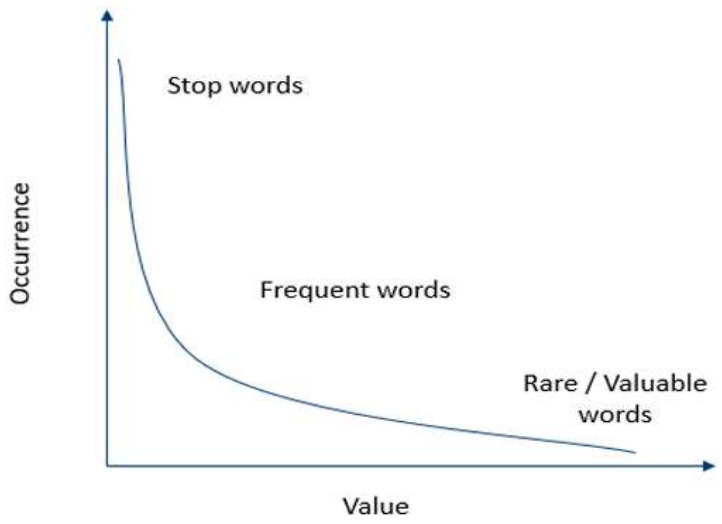
aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0

Step 4: Create Document Vectors for all the documents

- In this step, we combine all document vectors.
- Each row represents one document.
- Each column represents one word from the vocabulary.

Document Vector Table

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	0	0	0
0	0	1	0	0	1	1	1	0	1	1	1



The graph shows the relationship between **occurrence of words** and their **value (importance)**.

- Words with **very high occurrence** have **very low value**. These words are called **stop words** (e.g., is, the, and). Stop words do not give meaningful information about the text.
- Words with **moderate occurrence** have **medium value**. These words are called **frequent words**. They give some idea about the topic of the document.
- Words with low occurrence have high value. These words are called **rare or valuable** words. These words provide the most important information about the text.

TF-IDF

- TF-IDF stands for Term Frequency and Inverse Document Frequency.
- It helps in identifying the importance (value) of each word in a document.

Step 1: Term Frequency (TF)

- Term Frequency is the number of times a word appears in a document.
- These values are taken from the document vector (BoW table).

TF Table

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	0	0	0
0	0	1	0	0	1	1	1	0	1	1	1

Step 2: Document Frequency (DF)

- Document Frequency is the number of documents in which a word appears.
- It is counted across all documents.

DF Table

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
2	1	2	1	1	2	2	2	1	1	1	1

Step 3: Inverse Document Frequency (IDF)

- IDF measures the importance of a word.
- Formula: IDF = Total Documents ÷ DF
- Total documents = 3

IDF Table

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
3/2	3/1	3/2	3/1	3/1	3/2	3/2	3/2	3/1	3/1	3/1	3/1

Step 4: TF-IDF Calculation

- TF-IDF is calculated by multiplying TF with log(IDF).
- Formula: TF-IDF = TF × log(IDF)
- The IDF values are multiplied with each document row.

TF-IDF Table

aman	and	avni	are	stressed	went	to	a	therapist	download	health	chatbot
1×log(3/2)	1×log(3/1)	1×log(3/2)	1×log(3/1)	1×log(3/1)	0	0	0	0	0	0	0
1×log(3/2)	0	0	0	0	1×log(3/2)	1×log(3/2)	1×log(3/2)	1×log(3/1)	0	0	0
0	0	1×log(3/2)	0	0	1×log(3/2)	1×log(3/2)	1×log(3/2)	0	1×log(3/1)	1×log(3/1)	1×log(3/1)

To summarise,

- for a word to have a high TFIDF value, the word needs to have a high term frequency but less document frequency which shows that the word is important for one document but is not a common word for all documents.
- These values help the computer understand which words are to be considered while processing the natural language. The higher the value, the more important the word is for a given corpus.

Applications of TF-IDF

Application	Description
Document Classification	It helps in classifying the type and genre of a document.
Topic Modelling	It helps in predicting the topic of a corpus.
Information Retrieval System	It helps to extract important information from a corpus.
Stop Word Filtering	It helps in removing unnecessary words from a text body.

MCQs(1 MARK)

1. Which NLP application helps in converting natural speech in real time? (CBSE 2026)

A. Keyword Extraction tool

B. Translation of books from English to Hindi language.

C. Auto generated captions on YouTube

D. Classifying raw text into pre-defined groups.

2. Which type of chat bot requires coding and works on bigger databases directly ?(CBSE 2026)

A. Scriptbot B. Smart bot

C. Traditional bot D. Rule-based bot

3. Which NLP application is used by e-commerce websites to understand if a customer review is positive, negative, or neutral?

A. Automatic Summarization

B. Sentiment Analysis

C. Keyword Extraction

D. Machine Translation

4. A chatbot that follows a strict decision tree and cannot answer questions outside its programmed script is called a:(Board Exam 2022-23 (Marking Scheme Sec A, Q4-vi))

A. Smart Bot

B. Hybrid Bot

C. Script Bot

D. NLP Bot

5. What is the main difference between Stemming and Lemmatization? (Board Exam 2024 (Sec A, Q2-iv))

A. Stemming is more accurate than Lemmatization.

B. Lemmatization always returns a meaningful dictionary word (Lemma).

C. Stemming uses a dictionary to find the root word.

D. There is no difference; both are the same.

6. In a Bag-of-Words (BoW) model, if a word "AI" appears 5 times in a document of 100 words, what is its Term Frequency (TF)? (CBSE Facilitator Handbook (Unit 6: NLP))

A. 0.5

B. 5.0

C. 0.05

D. 500

7. Why does the word "The" usually have a very low TF-IDF score in a large collection of documents? (Board Exam 2022-23 (Sec A, Q4-iv))

A. Because it is a rare word.

B. Because it has high Inverse Document Frequency (IDF).

C. Because it appears in almost all documents, reducing its importance.

D. Because it is a technical keyword.

8. Which stage of NLP involves understanding the context and the real-world meaning behind a sentence? A. Lexical Analysis

B. Semantic Analysis

C. Morphological Analysis

D. Phonetic Analysis

9. **Which of these is NOT a common stopword in English NLP processing?**

A. And

B. Is

C. Algorithm

D. The

10. "Smart Bots" are often powered by _____, allowing them to learn from past interactions.

A. Fixed Scripts

B. Machine Learning and NLP

C. Hardcoded Rules

D. Manual Human Intervention

11. In a Bag of Words model, what is created after collecting and preprocessing text?

A. Image vectors

B. Audio signals

C. Document vectors

D. Stop words

12.Which of the following is NOT an NLP application?

A. Speech Recognition

B. Spam Filtering

C. Image Classification

D. Language Translation

1. Read the frequency chart:

Word	Frequency
machine	12
learning	14
is	45
the	50

Which pair contains most content-rich words?

A. is, the

B. machine, learning

C. learning, the

D. is, machine

2. Which NLP stage checks the grammatical structure of a sentence?

A. Semantic Analysis

B. Pragmatic Analysis

C. Syntactic Analysis

D. Tokenisation

3.Which NLP application helps identify whether a review is positive or negative?

A. Image Recognition

B. Sentiment Analysis

C. Object Detection

D. Computer Vision

4. Count the number of tokens including punctuation:
"Hello, how are you?"
A. 4

B. 5

C. 6

D. 7

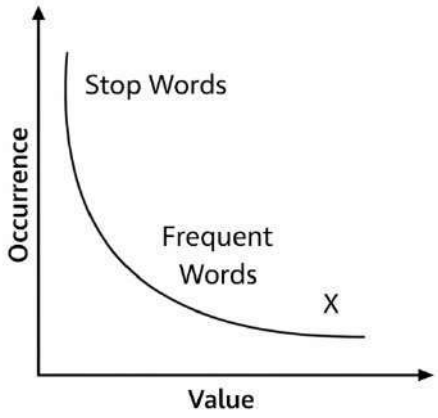
5. Identify the tokens in the sentence:
"NLP helps machines understand language."
A. NLP, helps, machines, understand, language , .

B. NLP helps, machines understand

C. NLP, helps, machines, understand, language

D. helps machines understand

6. In word frequency graph, X represents _____



A. Rare/valuable words
B. Punctuation words
C. Words with high frequency
D. Punctuations

7. In NLP, punctuation marks are usually treated as:
A. Stop words

B. Tokens

C. Stems

D. Errors

8. Two NLP systems processed the word **"playing"**:

System	Output
System A	play
System B	playing

Which conclusion is most appropriate?
A. System A performed stemming

B. System B performed tokenisation

C. Both systems removed stop words

D. System A performed sentence segmentation

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	B	B	C	B	C	C	B	C	B

Q1. Assertion (A): In the process of Text Normalization, Lemmatization is often preferred over Stemming for applications requiring high accuracy.

Reason (R): Stemming is a crude process that chops off the ends of words and may produce non-dictionary words, whereas Lemmatization ensures the output is a valid root word (Lemma)

(CBSE 2024 Board Paper)

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.

Answer : a)

Q2. Assertion (A): The TF-IDF model is considered more effective than the Bag-of-Words (BoW) model for identifying the most important keywords in a large collection of documents.

Reason (R): The Bag-of-Words model counts the frequency of words but fails to reduce the importance of common words like "the" or "is," which TF-IDF handles using Inverse Document Frequency.

O**ptions:**

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.

Answer : a)

VERY SHORT ANSWER QUESTIONS (VSA - 1-MARK)

1.What is Natural Language Processing (NLP)?

Natural Language Processing is a branch of Artificial Intelligence that helps computers understand and process human language.

2. Which NLP application converts speech into written text automatically?

Auto-generated captions or speech recognition systems.

3.Name any one virtual voice assistant that uses NLP. Alexa.

4. What is tokenization in NLP?

Tokenization is the process of breaking text into smaller parts called tokens or words.

5. Which NLP model counts the frequency of words in a document?

Bag of Words (BoW).

SHORT ANSWER QUESTIONS (2 Marks)

1.Differentiate between Script Bot and Smart Bot.

Script Bot	Smart Bot
Works on predefined rules	Uses AI and NLP
Gives fixed responses	Gives intelligent responses
Cannot learn from data	Learns from interactions

2.Explain any two applications of NLP used in daily life.

Voice assistants like Alexa and Siri use NLP to understand voice commands.

Language translation apps like Google Translate convert one language into another.

3. How is Stemming different from Lemmatization ? Explain how the word "Wolves" would be processed by stemming and lemmatization.(CBSE 2026)

Stemming	Lemmatization
It is the process in which the affixes of words are removed and the words are converted to their base form. The resultant stem word may/may not be meaningful.	It is the process in which the affixes of words are removed and the words are converted to their base form. The resultant Lemma word is always meaningful.

Stemming takes less time than lemmatization

Consider the following scenarios and identify which AI domain would be most appropriate for each, with justification: (CBSE 2026, Q18 (A))

An Al based education platform needs to translate to English language and analyze thousands of student essays to provide instant feedback on grammar, content quality and writing style.

Al Domain: Natural Language Processing (NLP)

Justification: Essay translation involves change of language and analysis involves understanding text, grammar checking, and content evaluation, which are core NLP applications.

(1 mark for correct identification of Al domain)

(1 mark for correct/relevant justification).

5. How does keyword extraction help search engines?

Keyword extraction identifies important words from text, helping search engines understand the topic and provide accurate search results.

6 .Differentiate between stemming and lemmatisation with suitable examples.

Stemming removes prefixes/suffixes to get the root form, which may not be a meaningful word.

Example: studies → studi

Lemmatisation converts a word into its meaningful base form using vocabulary and context.

Example: better → good

7. A chatbot gives incorrect replies because it cannot understand the context of previous sentences. Which NLP stage is missing here? Explain with an example.

The missing NLP stage is Discourse Integration.

It helps understand the meaning of words using previous sentences.

Example: In “Riya dropped the glass and it broke,” the word it refers to the glass.

8.Explain how Sentiment Analysis can help companies improve their products and services. Give one real-life example.

Sentiment Analysis identifies customer opinions as positive, negative, or neutral. Companies use it to understand customer feedback and improve products.

Example: Amazon analyzing product reviews to improve customer satisfaction.

9. A smart-bot performs better than a script-bot in handling user queries.

Give two reasons why smart-bots are more effective.

I.Smart-bots learn from data and improve over time.

II.They can handle complex queries using larger databases and AI techniques.

10.The sentence

"The bank is near the river."

can have multiple meanings depending on context. Which major challenge of NLP does this represent? Explain briefly.

This represents ambiguity, a major challenge in NLP.

The word "bank" may mean a financial institution or the side of a river, depending on context.

LONG ANSWER QUESTIONS: 4-MARK CASE-BASED / COMPETENCY-BASED QUESTIONS)

1. Consider the following documents:

Document 1: Data Science requires information.

Document 2: Information analysis requires data.

Implement all four steps of the Bag of Words (BoW) model to create a document vector table.

Answer:

Step 1: Text Processing (Preprocessing)After normalization:

Document 1: [data, science, requires, information]

Document 2: [information, analysis, requires, data]

Step 2: Create Dictionary (Vocabulary)

Unique words: data, science, information, analysis, requires

Step 3: Create Document Vector

Count frequency of each vocabulary word in Document 1:

	data	science	requires	information	analysis
Doc 1	1	1	1	1	0

Step 4: Create Document Vector Table for All Documents

	data	science	requires	information	analysis
Doc 1	**1**	1	1	1	**0**

(1 mark for each correct step)

(No mark to be deducted for combining Step 3 and Step 4)

2. A company wants to analyze customer reviews automatically using AI.

(a) Which NLP technique can identify customer emotions?
(b) Name the three types of sentiments.
(c) Give one positive review example.
(d) Give one negative review example.

Answer:

(a) Sentiment Analysis.
(b) Positive, Negative, Neutral.
(c) "The product quality is excellent."
(d) "The delivery service was very poor."

3.Read the following sentences:

Sentence 1:
"AI improves education."
Sentence 2:
"AI improves healthcare."
(a) Name the NLP model used to count word frequency.
(b) Which words are common in both sentences?
(c) Which words will have higher importance in TF-IDF?
(d) Why?

Answer:

(a) Bag of Words (BoW).

(b) AI, improves.

(c) Education and healthcare.

(d) Because they are unique words appearing in only one document.

4. Explain the stages of NLP with suitable examples.

Answer:

Stage	Explanation	Example
Lexical Analysis	Splits text into tokens	"AI helps" → AI, helps
Syntax Analysis	Checks grammar	"She is reading"
Semantic Analysis	Understands meaning	"Bank" has multiple meanings
Pragmatic Analysis	Understands intention	"Can you help me?"

5. A student writes the sentence:

"AI is AMAZING!!!"

(a) Which NLP process converts this text into a clean format?

(b) What is the normalized form of the sentence?

(c) Mention two techniques used in text normalization.

(d) Why is text normalization important?

Answer:

(a) Text Normalization.

(b) "ai amazing"

(c) Lowercase conversion and removing punctuation.

(d) Text normalization cleans text data and helps machines process information more accurately.

6. Consider the following documents:

Document 1: NLP is a domain of AI.
Document 2: NLP stands for Natural Language Processing.

Implement the four steps of the Bag of Words (BoW) model and generate TFIDF

Answer

Step 1: Text Normalisation

Document 1: NLP is a domain of AI
Document 2: NLP stands for Natural Language Processing

Document 1: [nlp, is, a, domain, of , ai]

Document 1: [nlp, stands, for, natural,language,processing]

Step 2: Creating dictionary
nlp, is, a, domain, of, ai, stands, for, natural, language, processing

Step 3: Create document vector table

	nlp	**is**	**a**	**domain**	**of**	**ai**	**stands**	**for**	**natural**	**language**	**processing**
Document1	1	1	1	1	1	1	0	0	0	0	0

Step 4: Create document vector table for all documents

	nlp	**is**	**a**	**domain**	**of**	**ai**	**stands**	**for**	**natural**	**language**	**processing**
Document1	1	1	1	1	1	1	0	0	0	0	0
Document2	1	0	0	0	0	0	1	1	1	1	1

<u>TFIDF Calculation</u>

Document Frequency

nlp	**is**	**a**	**domain**	**of**	**ai**	**stands**	**for**	**natural**	**language**	**processing**
2	1	1	1	1	1	1	1	1	1	1

Inverse document frequency

nlp	**is**	**a**	**domain**	**of**	**ai**	**stands**	**for**	**natural**	**language**	**processing**

2/2	2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1	2/1

TFIDF

nlp	**is**	**a**	**domain**	**of**	**ai**	**stands**	**for**	**natural**	**language**	**processing**
1×log(2/2)	1×log(2/1)	1×log(2/1)	1×log(2/1)	1×log(2/1)	1×log(2/1)	0×log(2/1)	0×log(2/1)	0×log(2/1)	0×log(2/1)	0×log(2/1)
1×log(2/2)	0×log(2/1)	0×log(2/1)	0×log(2/1)	0×log(2/1)	0×log(2/1)	1×log(2/1)	1×log(2/1)	1×log(2/1)	1×log(2/1)	1×log(2/1)

7.Consider the following documents:

Document 1: Sahil likes to play cricket
Document 2: Sajal likes cricket too
Document 3: Sajal also likes to play basketball

Apply all the four steps of Bag of Words model of NLP and generate document vector table

Answer

Step 1: Text Normalisation

Document 1: [sahil, likes, to, play, cricket]
Document 2: [sajal, too]
Document 3: [also, basketball]

Step 2: Create a Dictionary

sahil, likes, to, play, cricket, sajal, too, also, basketball

Step 3: Create a Document Vector

sahil	**likes**	**to**	**play**	**cricket**	**sajal**	**too**	**also**	**basketball**
1	1	1	1	1	0	0	0	0

Step 4: Repeat the above step for all Documents

sahil	likes	to	play	cricket	sajal	too	also	basketball
1	1	1	1	1	0	0	0	0
0	1	0	0	1	1	1	0	0
0	1	1	1	0	1	0	1	1

8.Consider the following documents:

Document 1: This is my first experience of Text Mining.

Document 2: I have learnt new techniques in Text Mining.

Apply steps of text normalization

Answer

Step 1: Sentence Segmentation

Document 1 → This is my first experience of Text Mining

Document 2 → I have learnt new techniques in this

Step 2: Tokenisation

This	is	my	first	experience	of	Text	Mining	I	have	learnt	new	techniques	in	this

Step 3: Removal of Stop Words, Special Characters and Numbers

first, experience, Text, Mining, learnt, new, techniques

Step 4: Convert to common case

first, experience, text, mining, learnt, new, techniques

Step 5: Stemming/Lemmatization

first, experience, text, mining, learn, new, technique

9.Read the following three documents and answer the questions that follow:

- Document 1: “Students love studying AI”
- Document 2: “AI is transforming education”
- Document 3: “Teachers and students explore AI tools”

After performing basic text pre-processing (removing punctuation, converting to lowercase, and tokenizing), the documents become:

- Document 1: [students, love, studying, ai]
- Document 2: [ai, is, transforming, education]
- Document 3: [teachers, and, students, explore, ai, tools]

Questions:

a) Create the dictionary (vocabulary) of unique words from all three documents.
b) Construct the document vector for Document 3 using this dictionary.
c) Explain how Bag of Words help in feature extraction.
d) Why is the order of words not considered important in Bag of Words?

Answer

a) Dictionary of unique words will be:
students, love, studying, ai, is, transforming, education, teachers, and, explore, tools

b) Document vector for Document 3

students	**love**	**studying**	**ai**	**is**	**transforming**	**education**	**teachers**	**and**	**explore**	**tools**
1	0	0	1	0	0	0	1	1	1	1

c) Bag of Words (BoW) helps in feature extraction by converting text documents into fixed-length numerical vectors based on the frequency or presence of words from a defined

vocabulary. This allows machine learning models to process and analyze text data just like numeric input, enabling tasks such as text classification, sentiment analysis, and topic modeling.

d) In Bag of Words, the focus is on what words appear, not how or where they appear in the sentence. The model treats text as a "bag" of words, ignoring grammar, syntax, and word order.

Hindi Audio	English Audio	Hindi Video	English Video	Quiz

Quiz Link : https://forms.gle/i756im5psjfeZKBUA

NATURAL LANGUAGE PROCESSING

REVISION POINTS

1 NATURAL LANGUAGE VS COMPUTER LANGUAGE

Natural Language	Computer Language
• Human languages such as English, Hindi, French. • Used for communication. • Meaning depends on context.	• Python, Java, C++, HTML. • Used to communicate with computers. • Follows strict rules.

NLP: Branch of AI that helps computers understand, interpret and process human language.

2 FEATURES OF NATURAL LANGUAGE

- Follows syntax, lexicon and semantics.
- Same information can be expressed in different ways.
- Changes over time.
- Meaning depends on context.

3 APPLICATIONS OF NLP

- Voice Assistants
- Auto-generated Captions
- Language Translation
- Sentiment Analysis
- Text Classification
- Keyword Extraction

4 STAGES OF NLP

1. **Lexical Analysis** — Breaks text into words and sentences.
2. **Syntactic Analysis** — Checks grammar.
3. **Semantic Analysis** — Checks meaning.
4. **Discourse Integration** — Connects sentences logically.
5. **Pragmatic Analysis** — Understands intended meaning using context.

5 CHATBOTS

A chatbot is a computer program that simulates human conversation using NLP.

Script Bot	Smart Bot
Script bots are easy to make.	Smart bots require coding to develop.
Work on pre-defined scripts.	Work on larger databases and resources.
Mostly free and easy to integrate.	Require more resources and setup.
No or very little language processing ability.	Use NLP and learn from data.
Do not learn from interactions.	Learn with more data over time.
Limited functionality.	Wide and advanced functionality.
Less flexible.	Flexible and powerful.
Eg: Bank IVR Systems, Basic website FAQ bots	Eg: ChatGPT

6 TEXT NORMALISATION

Corpus: Collection of text documents.

STEPS

1. Sentence Segmentation
2. Tokenization
3. Removing Stop Words
4. Removing Special Characters & Numbers
5. Converting to Lowercase
6. Stemming
7. Lemmatization

7 STEMMING vs LEMMATIZATION

Stemming	Lemmatization
Faster	Slower
May give meaningless roots	Gives meaningful roots
studies → studi	studies → study
caring → car	caring → care

8 BAG OF WORDS (BoW)

Provides:
- Vocabulary of words
- Frequency of words

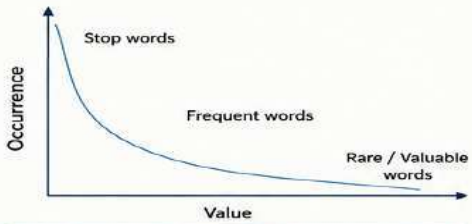
BoW

STEPS

1. Collect and process text
2. Create vocabulary
3. Create document vectors
4. Combine all document vectors

Word Present → 1
Word Absent → 0

9 WORD IMPORTANCE (VALUE)



High occurrence → Low value → Stop words

Medium occurrence → Moderate value

Low occurrence → High value → Valuable words

10 TF-IDF

Full Form: Term Frequency – Inverse Document Frequency

TF = Number of times a word appears in a document

DF = Number of documents containing the word

$$IDF = \frac{\text{Total Documents}}{DF}$$

$$TF\text{-}IDF = TF \times \log(IDF)$$

KEY POINT

A word gets a high TF-IDF value when:
- It appears frequently in a document (high TF).
- It appears in fewer documents (low DF).

11 APPLICATIONS OF TF-IDF

- **Document Classification** — Helps in categorizing documents.
- **Topic Modelling** — Identifies topics present in documents.
- **Information Retrieval Systems** — Improves search results by ranking important documents.
- **Stop Word Filtering** — Helps in identifying and removing unimportant words.

SAMPLE QUESTION PAPER - 1 (2026-27)
CLASS- X
SUBJECT: ARTIFICIAL INTELLIGENCE (417)

Max.Marks:50 **TIME: 2 Hrs**

General Instructions:

1. Please read the instructions carefully.
2. This Question Paper consists of **21 questions** in two sections: Section A & Section B.
3. Section A has Objective type questions whereas Section B contains Subjective type questions.
4. Out of the given (5 + 16 =) 21 questions, a candidate has to answer (5 + 10 =) 15 questions in the allotted (maximum) time of 2 hours.
5. All questions of a particular section must be attempted in the correct order.
6. SECTION A - OBJECTIVE TYPE QUESTIONS (24 MARKS):
i. This section has 05 questions.
ii. Marks allotted are mentioned against each question/part.
iii. There is no negative marking.
iv. Do as per the instructions given.
7. SECTION B – SUBJECTIVE TYPE QUESTIONS (26 MARKS):
i. This section has 16 questions.
ii. A candidate has to do 10 questions.
iii. Do as per the instructions given.
iv. Marks allotted are mentioned against each question/part.

SECTION A: OBJECTIVE TYPE QUESTIONS

Q1	**Answer any 4 out of the given 6 questions on Employability Skills (1 x 4 = 4 marks)**	Marks
i	SAINIKA is a class X student. Due to the pandemic, he is learning online. Her teacher asks her to create a YouTube video in which she can make people aware of protecting themselves against the Coronavirus. She uses her own voice in the video and adds some photos and background music to enhance its effect. After sharing it with her friends, relatives and teachers, she receives their feedback. Which of the following feedback is considered descriptive? (i) Well done, Bro! (ii) Keep up the good work! (iii) Fantastic video! You did an excellent job. You chose accurate images with extremely calming background music. Your explanation of the topic with perfect pronunciation was also quite effective.	1

	(iv) Nice. Very informative video!	
ii	Which of the following can cause stress? (a) Yoga and meditation (b) Financial difficulties (c) Organized academic life (d) Enjoying holidays with family	1
iii	Which of the following is not a virtual assistant? (a)Alexa (b)Siri (c) Cortana (d) Chatbot	1
iv	What is the term used when you quickly click the left mouse button twice? (a) Hover (b) Drag and drop (c) Double clicking (d) Moving	1
v	CHARCHIT learnt that if a laptop gets overheated, the internal parts get damaged. What happens if he leaves his device plugged in even after it is charged 100%? (a) It can break (b) It can stop functioning (c) It can overheat (d) Data can get corrupt	1
vi	Sonakshi is a young lady who makes bags. She buys jute from a farmer and makes bags from that. She sees that most women in her village do not work. So, she hires two women to help her. As her orders increase, she hires three more women to work for her. How was she helping her village grow? (a) By selling bags to women without a job. (b) By purchasing bags from the local market. (c) By buying jute from the local farmer and by providing jobs to local women (d) By attracting the women in her village with her creative earrings	1
Q.2	**Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)**	
i	_____ and _____ are AI based applications that help us in navigation.	1
ii	"This type of intelligence measure's one's awareness of the natural world around them and their sensitivities to any changes that occur. It allows us to identify the variation among two different species and understand how they are related". Identify the type of intelligence described in the above sentence.	1
iii	Identify the incorrect statement(s) from the following: (i) Deep learning is a subset of Machine Learning (ii) Machine Learning is a subset of Deep Learning (iii) Artificial Intelligence is a subset of Deep Learning (iv) Deep Learning is the advanced form of AI and ML (a) only (i) (b) (ii) and (iii) (c) (i) and (ii) (d) Only (iii)	1
iv	During Data Acquisition, feeding previous data into the machine is called: a) Training Data b) Predicting Data	1

	c) Testing Data d) Evaluating Data	
v	When a user installs an app in the smartphone, it asks for access to gallery, contacts, etc. After accepting this, it gives the user agreement which most users accept without realizing the implications. What is the concern here? (a) Data Privacy (b) Unemployment (c) AI bias (d) No concern	1
vi	_____means a picture element which is the smallest unit of information that makes up a picture. a) Vision b) Pics c) Pixel d) Piskel	1
Q.3	**Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)**	
i	_____ helps us to summarise all the key points into one single Template so that in future, whenever there is a need to look back at the basis of the problem, we can take a look at this and understand the key elements of it.	1
ii	ARNAV was learning neural networks. He understood that there were three layers in a neural network. Help him identify the layer that does processing in the neural network. (a) Output layer (b) Hidden layer (c) Input layer (d) Data layer	1
iii	Bhaktirupa is working on a project that involves over a lakh of records. Which of the following should she use to make the best project? (a) Traditional programming (b) Manual processing (c) IoT (d) Neural networks	1
iv	Which of the following statements is correct? (a) An AI model is a computer program that has been taught to identify specific patterns. (b) An AI model is a human who has been trained to instruct machines. (c) An AI model is a robot that has been programmed to instruct humans. (d) An AI model requires a large amount of data to derive a relationship in the data. (i) (a) and (d) only (ii) (b) and (d) only (iii) (a) and (c) only (iv) (a), (c) and (d)	1
v	The _____Sustainable Development Goals (SDGs) were launched at the United Nations Sustainable Development Summit in New York in the year 2015, forming the 2030 Agenda for Sustainable Development. (a) 17 (b) 15 (c) 13 (d) 19	1
vi	Which of the following is performed by Data Scientist? (a) Define the question (b) Create reproducible code (c) Challenge results (d) All of the mentioned	1

Q.4	**Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)**	
i	_____ helps in assigning a predefined category to a document, organize it in such a way that helps customers to find information they want. For example, spam filtering in email, auto tagging on social media, categorization of news articles etc.	1
ii	Which of the following is the type of data used by NLP applications? (a) Images (b) Numerical data (c) Graphical data (d) Text and Speech	1
iii	Ayushi was learning about NLP. She wanted to know the term used for the whole textual data from all the documents altogether. Help her in identifying the term used for it.	1
iv	What is the full form of CV?	1
v	Choose the correct option: (i) Classification -> continuous data (ii) Regression -> discrete data sets (iii) Clustering -> unknown data set (iv) Decision Tree -> Only discrete data	1
vi	*Identify the type of chatbot with the information given below:* These bots work on pre-programmed instructions inside the application/machine and are generally easy to develop. They are deployed in the customer care section of various companies. Their job is to answer some basic queries that they are coded for and connect them to human executives once they are unable to handle the conversation.	1
Q.5	**Answer any 5 out of the given 6 questions (1 x 5 = 5 marks)**	
i	_____ is a term used for any word or number or special character occurring in a sentence . (Token/ Punctuator)	1
ii	_____ is used to record the result of comparison between the prediction and reality. It is not an evaluation metric but a record which can help in evaluation.	1
iii	A weather predicting AI model predicted that Tamil Nadu face a tsunami but no such incidence took place. Under which category of the confusion matrix will this be marked? (a) False Positive (c) False Negative (b) True Positive (d) True Negative	1
iv	Which two evaluation methods are used to calculate F1 Score? (a) Precision and Accuracy (b) Precision and Recall (c) Accuracy and Recall (d) Precision, F1 score	1
v	An AI application that has a higher level of intelligence and is capable of	1

	understanding open-ended questions and providing assistance in finding the most relevant replies beyond the pre-scripted responses it learns over time using NLP. It is ideal for dealing with customer support concerns, resolving typical issues, aiding account administration and offering general assistance. Which of the following applications can you relate to this? (i) Automatic Number Plate Recognition (ii) Alexa (iii) Smart Chatbot (iv) Spam filters	
vi	BISHNUPRIYA was confused with the terms used in the evaluation stage. Suggest her the term used for the percentage of correct predictions out of all the observations. (a) Accuracy (b) Precision (c) Recall (d) F1 Score	1
SECTION B: SUBJECTIVE TYPE QUESTIONS **Answer any 3 out of the given 5 questions on Employability Skills (2 x 3 = 6 marks)** **Answer each question in 20 – 30 words.**		
Q.6	In SMART goals, what does 'A' stand for? Explain.	2
Q.7	Ekta is always punctual at school. She has a regular schedule that she follows every day. She plans for study and play time in advance. Enlist the four steps Ekta must have followed for effective time management.	2
Q.8	How can a virus infect a computer? List two ways.	2
Q.9	What do entrepreneurs do when they run their business? Mention any two points.	2
Q.10	NIHAR has a small convenience store in his locality. There are many other convenience stores in the area. Yet, NIHAR's store survives the competition and does well. Which stage of an entrepreneur's career process can you relate this to? Explain.	2
Answer any 4 out of the given 6 questions in 20 – 30 words each (2 x 4 = 8 marks)		
Q.11	How do you understand whether a machine/application is AI based or not? Explain with the help of an example.	2
Q.12	If you do an image search for vacations on a popular search engine, the first few searches mostly return the picture of beaches. What is the concern here? Explain.	2
Q13	JYOTIRMAYEE works for a company wherein she was assigned the task of developing a project using AI project cycle. She knew that the first stage was scoping the problem. Help her list the remaining stages that she must go through to develop the project.	2
Q.14	What will be the results of conversion of the term, *'happily'* in the process of stemming	2

	and lemmatization? Which process takes longer time for execution?	
Q.15	What do we get from the “bag of words" algorithm?	2
Q.16	People of a village are totally dependent on the farmers for their daily food items. Farmers grow new seeds by checking the weather conditions every year. An AI model is being deployed in the village which predicts the chances of heavy rain to alert farmers which helps them in doing the farming at the right time. Which evaluation parameter out of precision, recall and F1 Score is best to evaluate the performance of this AI model? Explain.	2
	Answer any 3 out of the given 5 questions in 50– 80 words each (4 x 3 = 12 marks)	
Q.17	Anshuman is amazed to learn about his sister Ananya who is multi-talented and has excelled in academics, music, dancing, sports and painting. He was quite curious when Ananya told him that he too possessed all these intelligences like every human being does, but only at different levels. He wondered which intelligence she was talking about. Can you help Anshuman in learning about different types of intelligences by naming and explaining any four types of intelligences?	4
Q18	Shreehari attended a seminar on Artificial Intelligence and has now been asked to write a report on his learnings from the seminar. Being a non-technical person, he understood that the AI enabled machine uses data of different formats in many of the daily based applications but failed to sync it with the right terminologies and express the details. Help Shreehari define Artificial Intelligence, list the three domains of AI and the data that is used in these domains.	4
Q.19	Neural networks are said to be modelled the way how neurons in the human brain behave. A similar system is mimicked by the AI machine to perform certain tasks. Explain how neural networks work in an AI model and mention any three features of Neural Networks.	4
Q.20	Nisita, a student of class X was exploring the Natural Language Processing domain. She got stuck while performing the text normalisation. Help her to normalise the text on the segmented sentences given below: Document 1: Akash and Ajay are best friends. Document 2: Akash likes to play football but Ajay prefers to play online games.	4
Q.21	Draw the Confusion matrix with following data given below and find out the a) precision b) recall and c) F1 Score the number of true positive = 100 the number of true negative 47 the number of false positive = 62 the number of false negative = 290	4
	**********	

MARKING SCHEME

Max.Marks:50 **TIME: 2 Hrs**

SECTION A: OBJECTIVE TYPE QUESTIONS

Que	Answer	Marks
Q1		
i	(iii) Fantastic video! You did an excellent job. You chose accurate images with extremely calming background music. Your explanation of the topic with perfect pronunciation was also quite effective.	1
ii	(b) Financial difficulties	1
iii	(d) Chatboat	1
iv	(c) Double clicking	1
v	(c) It can overheat	1
vi	(c) By buying jute from the local farmer and by providing jobs to local women	1
Q.2		
i	Google Maps, Ola, Uber (any relevant application name with similar functionality can be considered)	1
ii	Naturalist Intelligence	1
iii	(b) (ii) and (iii)	1
iv	a) Training Data	1
v	(a) Data Privacy	1
vi	(c) Pixel	1
Q.3		
i	Problem Statement Template	1
ii	(b) Hidden layer	1
iii	(d) Neural networks	1
iv	(i) (a) and (d) only	1
v	(a) 17	1
vi	(d) All of the mentioned	1
Q.4		
i	Text Classification	1
ii	(d) Text and Speech	1
iii	Corpus	1
iv	Computer Vision	1
v	(iii) Clustering -> unknown data set	1
vi	Script bot	1
Q.5		
i	Token	1
ii	Confusion Matrix	1
iii	(a) False Positive	1

iv	(b) Precision and Recall	1
v	(iii) Smart Chatbot	1
vi	(a) Accuracy	1
SECTION B: SUBJECTIVE TYPE QUESTIONS **Each Answer question in 20 – 30 words.**		
Q.6	In SMART goals, A refers for Achievable, it means breaking down big goals into smaller parts will make the goal achievable. For example Bigger Goal: "I want to become a teacher in my school." Breaking it into smaller goals: Complete higher secondary Complete Graduation Complete B.Ed. Apply for jobs in the teaching field *(1 mark for identification; 1 mark for explanation)*	2
Q.7	The four steps of effective time management which Sameera must have followed are: (i) Organise (ii) Prioritise (iii) Control (iv) Track *(½ mark for every step, ½ * 4 =2)*	2
Q.8	Two methods how virus get into the computer: 1. Using pen drive without scanning. 2. Not installing Anti-virus and Firewall 4. No opening Secure sites rather opening unsecure sites *(1 mark for each correct method, 1*2=2)*	2
Q.9	I. Fulfil Customer Needs II. Use Local Materials III. Help Society IV. Create Jobs V. Sharing of Wealth VI. Lower Price of Products *(1 mark for each correct point, 1*2=2)*	2
Q. 10	This stage is the Survive stage of an entrepreneur's career process. In this stage, even if there are many entrepreneurs in the market, the new entrepreneur has to remain in a competitive market. *(1 mark for mentioning the stage; 1 mark for correct explanation)*	2
Answers in 20 – 30 words each (2 x 4 = 8 marks)		

Q. 11	Any machine that has been trained with data and can make decisions/predictions on its own can be termed as AI. Eg:The bot or the automation machine is not trained with any data is not an AI while a chatbot that understands and processes human language is an AI. (*1 mark for correct explanation; ½ mark for example of AI; ½ mark for example of not AI*)	2
Q. 12	In the given scenario, we are concerned about the bias. When we talk about a machine, we know that it is artificial and cannot think on its own. It can have intelligence, but we cannot expect a machine to have any biases of its own. Any bias can transfer from the developer to the machine while the algorithm is being developed. *(1 mark for mentioning the term bias; 1 mark for the correct explanation)*	2
Q. 13	Steps of AI project life cycle: 1. Data Acquisition 2. Data Exploration 3. Modelling 4. Evaluation *(½ mark for mentioning each stage,½ *4=2)*	2
Q. 14	Stemming Lemmatization happily happi happy Process that takes longer time for execution is lemmatization *(½ marks each for identifying the correct stem and lemma; 1 mark for identifying the correct process)*	2
Q. 15	Bag of words gives us two things: 1. A vocabulary of words for the corpus 2. The frequency of these words (number of times it has occurred in the whole corpus) *(1 mark for each point)*	2
Q. 16	Let us take each of the factor into consideration at once, If precision is considered, FN cases will not be taken into account, so it will be of great loss as if the machine will predict there will be no heavy rain, but if the rain occurred, it will be a big monetary loss due to damage to crops. If only recall is considered, then FP cases will not be taken into account. This situation will also cause a big amount of loss, as all people of the village are dependent on farmers for food, and if the model predicts there will be heavy rain and the farmers may not grow crops, it will affect the basic needs of the people. Hence F1 Score is the best suited parameter to test this AI model, which is the balance between Precision and Recall. *(1 mark for identifying the term F1 score; 1 mark for relevant explanation)*	2
Answers in 50– 80 words each (4 x 3 = 12 marks)		

Q. 17	All humans possess 9 types of intelligence but at different levels. They are: 1. Mathematical Logical Reasoning: ability to regulate, measure, and understand numerical symbols, abstraction and logic. 2. Linguistic Intelligence: Language processing skills both in terms of understanding or implementation in writing or verbally. 3. Spatial Visual Intelligence : ability to perceive the visual world and the relationship of one object to another. 4. Kinaesthetic Intelligence : ability that is related to how a person uses his limbs in a skilled manner. 5. Musical Intelligence : ability to recognize and create sounds, rhythms, and sound patterns. 6. Intrapersonal Intelligence : Describes how high the level of self-awareness someone has is. Starting from realizing weakness, strength, to his own feelings. 7. Existential Intelligence : An additional category of intelligence relating to religious and spiritual awareness. 8. Naturalist Intelligence : An additional category of intelligence relating to the ability to process information on the environment around us. 9. Interpersonal intelligence : ability to communicate with others by understanding other people's feelings & influence of the person. *(½ mark for the naming the intelligence; ½ mark for the explanation of the same; (½ + ½) * 4 = 4)*	4
Q. 18	Artificial Intelligence (AI) refers to any technique that enables computers to mimic human intelligence i.e., make decisions, predict the future, learn and improve on its own. With respect to the type of data fed in the AI model, AI models can be broadly categorised into three domains: 1. Data sciences 2. Computer vision 3. Natural Language Processing Data Science takes input in the form of numeric and alphanumeric data. Computer Vision takes input in the form of images and videos. Natural Language Processing takes input in the form of text and speech. *(1 mark for definition of AI; ½ mark each for the names of the domains; ½ mark each for the type of data input to domains)*	4
Q. 19	Neural networks are loosely modelled after how neurons in the human brain behave. The features of a neural network are : 1. They are able to extract data features automatically without needing the input of the programmer.	4

<table>
<tr><td></td><td>2. A neural network is essentially a system of organizing machine learning algorithms to perform certain tasks.
3. It is a fast and efficient way to solve problems for which the dataset is very large, such as in images.

(1 mark for how neural networks are modelled; 1 mark each for relevant feature of neural network)</td><td></td></tr>
<tr><td>Q. 20</td><td>1. Tokenisation
Akash, and, Ajay, are, best, friends
Akash, likes, to, play, football, but, Ajay, prefers, to, play, online, games
2. Removal of stopwords
Akash, Ajay, best, friends
Akash, likes, play, football, Ajay, prefers, play, online, games
3. converting text to a common case
akash, ajay, best, friends
akash, likes, play, football, ajay, prefers, play, online, games
4. Stemming/Lemmatisation
akash, ajay, best, friend
akash, like, play, football, ajay, prefer, play, online, game
(1 mark for each step; 1*4=4)</td><td>4</td></tr>
<tr><td>Q. 21</td><td><table><tr><td>Confusion matrix</td><td colspan="2">Reality</td></tr><tr><td>Prediction</td><td>yes</td><td>no</td></tr><tr><td>yes</td><td>100</td><td>62</td></tr><tr><td>no</td><td>290</td><td>47</td></tr></table>
Precision=TP/(TP+FP)= 0.61
Recall=TP/(TP+FN)=0.25
F1 Score=(2 x Precision x Recall) / (Precision + Recall)=0.354

1 mark for correct confusion matrix, 1 mark for correct formula and value of Precision, 1 mark for correct formula and value of Recall and 1 mark for correct formula and value of F1 Score.</td><td>4</td></tr>
<tr><td></td><td>**********</td><td></td></tr>
</table>

PART A (EMPLOYABILITY SKILLS)						
		Audio		Video		Interactive Questions Link
		Hindi	English	Hindi	English	
1	Communication skills - II					
2	Self-Management Skills - II					
3	ICT Skills - II					
4	Entrepreneurial Skills - II					
5	Green Skills II					
PART B (SUBJECT SPECIFIC SKILLS)						
6	Revisiting AI Project Cycle & Ethical Frameworks for AI					
7	Advanced Concepts of Modeling in AI					

8	Evaluating Models					
9	Computer Vision					
10	Natural Language Processing					
11	Sample Paper	Question Paper			Marking Scheme	

Interactive Questions Links
PART A (EMPLOYABILITY SKILLS)

1. Communication skills - II
   https://forms.gle/a4tEsUv9W7w2dydN9

2. Self-Management Skills – II
   https://forms.gle/UbNpT1xR5Luni6X36

3. ICT Skills – II
   https://forms.gle/DVR6RwFr24WDjazS7

4. Entrepreneurial Skills – II
   https://forms.gle/KaJXazkkauKsonny8

5. Green Skills II
   https://forms.gle/rJxMFTF3FXiVsWPy6

PART B (SUBJECT SPECIFIC SKILLS)

6. Revisiting AI Project Cycle & Ethical Frameworks for AI
   https://forms.gle/8AwmcZK9ZvVRaP929

7. Advanced Concepts of Modeling in AI
   https://forms.gle/AFroGzQFDTg6xGsw6

8. Evaluating Models
   https://forms.gle/6BuuRkcfP4piF6S56

9. Computer Vision
   https://forms.gle/hGo9fSmdVc7jLdTYA

10. Natural Language Processing
    https://forms.gle/i756im5psjfeZKBUA

11. Question Paper
    https://drive.google.com/file/d/1h8xj6PsHrw1XtTDDSxLS5rAURVoc0gqM/view?usp=sharing

12. Marking Scheme
    https://drive.google.com/file/d/1_zvgugUpGRhsDGsK79h7XxTf-Tm9CFET/view?usp=sharing