SCS Learning Education Online

Class XII
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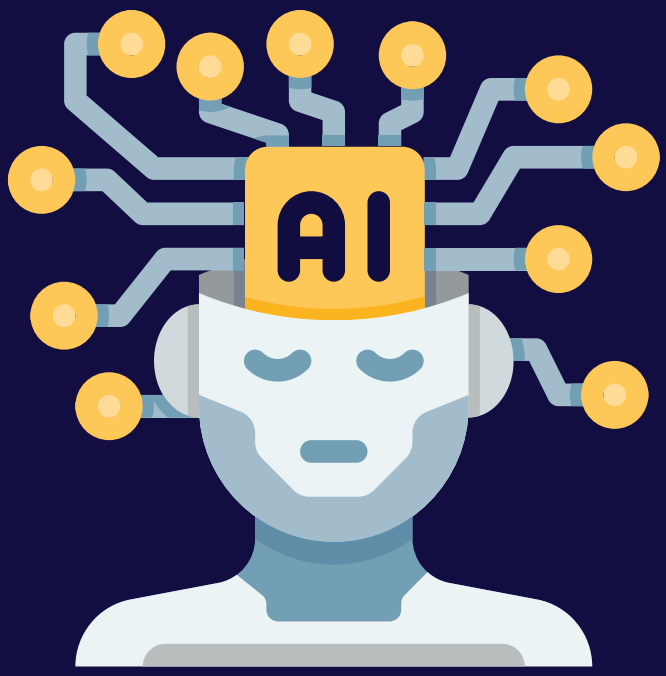
Syllabus

DECODING ARTIFICIAL INTELLIGENCE

Skill Course (Code 843) with Project Work

TEACHER'S MANUAL



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Educational Publishers

Employability Skills

Chapter 1: Communication Skills-IV

I. Unsolved Questions

A. Short Answer Type Questions

1. **Effective communication** is about sharing ideas clearly, concisely and accurately so that the listener understands and responds appropriately. **Talking a lot** may involve speaking without clarity or purpose, which often leads to confusion. For example, saying, "I was thinking may be we could have some fun, like watch a movie… the superhero one… or the latest one" might confuse the listener. Instead, saying, "Would you like to watch the new superhero movie this Saturday evening?" is clear and effective. Good communication values the listener's time and understanding.

2. **Nouns** name **people, places, things or ideas** (*e.g.*, book). **Verbs** describe actions or states of being (*e.g.*, run). **Adjectives** describe nouns and pronouns (*e.g.,* red). **Adverbs** modify verbs, adjectives or other adverbs and tell how, when, where or to what degree (*e.g.,* quickly). These **parts of speech** are the building blocks of communication. For instance, in the sentence 'the quick fox jumps high', 'fox' is a noun, 'jumps' is a verb, 'quick' is an adjective and 'high' is an adverb.

3. In **active voice**, the subject performs the action. For example, 'the chef cooked a delicious meal'. The chef (subject) performs the action (cooked). In **passive voice**, the subject receives the action, such as 'a delicious meal was cooked by the chef'. Here, the focus is on the meal. Active voice is direct and clearer, while passive voice is useful when the doer is unknown or less important.

4. **Declarative sentences** state facts or opinions (*e.g.,* 'The Earth revolves around the Sun.'). **Interrogative sentences** ask questions (*e.g.,* 'What time is it?'). **Imperative sentences** give commands or requests (*e.g.,* 'Please close the door.'). **Exclamatory sentences** express strong emotions (*e.g.,* 'Wow! The view is breathtaking!'). These sentence types help convey intent clearly in different situations and are essential tools for effective communication.

5. A **paragraph** is a group of sentences focused on a single main idea. It typically starts with a **topic sentence**, followed by **supporting sentences** that provide details, examples or explanations. **Transition words** help ensure flow and clarity, while a **concluding sentence** wraps up the idea. For example, a paragraph about the Amazon rainforest may start with its importance, support it with examples of biodiversity and climate role, and end with a call to protect it.

6. Understanding concepts of **communication and writing** strengthens both verbal and written expression. Effective communication requires clarity, conciseness and accuracy, which are also essential in writing. Knowing how messages flow through the communication cycle from sender to receiver, with encoding, decoding and feedback, enables one to construct messages that are **better understood**. Similarly, understanding parts of speech and sentence structure **enhances grammar and sentence formation**. For instance, using clear subject-verb-object structures **improves readability**. Learning active listening **builds better engagement** and ensures that one responds thoughtfully in both spoken and written interactions. Writing skills, such as organizing content using topic sentences, supporting ideas, transition words and proper punctuation, also improve how we **present ideas** in speech. The ability to balance different sentence types—declarative, interrogative, imperative and exclamatory—adds a **touch of emotion** to both writing and speaking. Communication and writing are deeply interconnected. Mastering one contributes significantly to the other, leading to stronger expression in academic, personal and professional settings.

7. To ensure a presentation is clear and engaging, I would use **effective communication strategies** such as **clarity, conciseness** and **active engagement**. I would begin with a clear **introduction**, using a declarative sentence to state the **purpose**. To keep my message focused, I would organize my speech using **well-structured paragraphs**, starting with a **topic sentence and supporting details**. I would avoid unnecessary jargon and use simple, **accurate language**. To maintain attention, I would use vocal variation, facial expressions and eye contact. These **non-verbal cues** will help to support my verbal message. **Active listening** would also be key—by observing audience reactions, I could adjust my **pace** or **rephrase** points for clarity. I would use interrogative sentences to involve my classmates and encourage participation. **Visual aids** and **examples** would serve as supporting sentences to strengthen my points. I would conclude with a **summary and a call to action** using an imperative sentence, ensuring my message leaves a lasting impression.

8. In a persuasive essay, **sentence structure** and **clear language** play a crucial role in convincing the reader. Using **well-structured sentences**, such as compound and complex sentences, helps present main points along with supporting ideas logically. A **clear topic sentence** at the beginning of each paragraph introduces the **main idea**, while **supporting sentences elaborate** it using examples or facts. **Transition words** like 'therefore', 'however' and 'for instance' help connect ideas smoothly, improving flow and **coherence**. **Sentence variety**—including declarative for facts, interrogative for rhetorical questions and exclamatory for emotional appeal—keeps the reader engaged and emphasizes important points. **Accurate grammar** ensures professionalism and prevents misinterpretation. For instance, active voice makes arguments more direct and impactful, while passive voice can be used to shift focus when needed. Effective sentence structure and clear language not only strengthens **logical appeal** but also **builds credibility** and keeps the reader focused on the argument.

9. To resolve a disagreement constructively, **active listening** is essential. First, I would **minimize distractions** and **maintain eye contact**, ensuring my friend feels heard. I would pay **full attention**, listening not just to their words but also to the **tone and body language**. Using **non-verbal cues** like nodding would show engagement. I would also use **paraphrasing** to confirm clarity. Delaying my judgment and avoiding interruption will allow my friend to fully express their thoughts. I would **empathize**, trying to understand their emotions and point of view, which will help build trust. Asking **clarifying questions** will help to show that I care about resolving the issue. After the conversation, I would **reflect on key points** and suggest **solutions** respectfully. Using clear, concise and accurate language, I would express my **own perspective** without blaming them. By focusing on understanding rather than reacting, and following the **RESPECT framework** (Receive, Empathize, Summarize, Pay attention, Engage, Clarify doubts, Time/Thank), conflicts can be resolved calmly and respectfully.

10. Using a **mix of sentence types** makes a blog post engaging and dynamic. **Declarative sentences** help to present facts and main ideas clearly. For example, "Effective communication is essential in everyday life." This sets the foundation of your argument or message. **Interrogative sentences** create curiosity and prompt the reader to think, such as, "Have you ever felt misunderstood during a conversation?" They invite the reader into a dialogue. **Imperative sentences** provide guidance or encourage action— "Try listening without interrupting," or "Pay close attention to body language." These motivate the reader to act on the content. **Exclamatory sentences** convey enthusiasm or highlight key emotions— "Wow! Just one change can improve your communication skills!" This type adds energy and emotion. A good blog post balances all four sentence types to **inform, question, encourage and excite** the reader. Also, using transition words and varying sentence length adds rhythm and flow, keeping the writing fresh and engaging throughout.

B. Long Answer Type Questions

1. The **topic sentence** plays a crucial role in a paragraph by introducing its **main idea**. It provides the reader with a **clear understanding** of what the paragraph is about. A strong topic sentence acts like a roadmap, guiding the reader through the content that follows. It sets the **tone and context**, allowing the supporting sentences to build upon a defined theme. For example, in the paragraph, "Amazon rainforests are vital to our planet's health," this opening sentence prepares the reader to learn about biodiversity, climate control and the importance of conservation. Without a topic sentence, the paragraph may seem confusing because of its lack of focus. A well-written topic sentence ensures coherence and unity, which are essential for effective writing. It also helps the readers skim through a document and quickly grasp the content of each section. The topic sentence is not just the starting point but the anchor of the entire paragraph.

2. **Supporting sentences** follow the topic sentence and develop the paragraph's main idea with **details, examples, facts or explanations**. Their primary purpose is to provide depth, clarity and evidence for the central thought introduced in the topic sentence. These sentences ensure that the reader understands the idea thoroughly

by offering context or elaboration. For instance, if the topic sentence is 'Amazon rainforests are vital to our planet's health,' the supporting sentences might explain the forest's biodiversity, role in climate regulation and impact on global ecosystems. Without supporting sentences, a paragraph would feel incomplete and unconvincing. They also help maintain the reader's interest and understanding by building a logical flow of information. Effective use of supporting sentences ensures that the paragraph is informative, persuasive and cohesive, helping to communicate the writer's message with impact and clarity.

3. **Transition words and phrases** connect sentences and ideas, helping readers follow the flow of thought in a paragraph. They act as bridges between ideas, ensuring a smooth and logical progression. Their importance lies in maintaining coherence and clarity. Without transitions, writing can appear disjointed. For example, transition words such as 'however', 'in addition', 'therefore' and 'for instance' help indicate relationships such as contrast, cause-effect and examples. Consider a paragraph on climate change: "The Earth is warming rapidly. Therefore, global sea levels are rising. In addition, weather patterns are becoming unpredictable." Here, transition words clearly show how ideas relate to one another.

   Transition words for different purposes include:

   – **Addition:** also, furthermore, in addition

   – **Cause and effect:** therefore, thus, as a result

   – **Example:** for instance, such as, for example

   – **Contrast:** however, but, on the other hand

   – **Conclusion:** in conclusion, finally, to sum up

4. Using a **variety of sentence lengths** adds rhythm and interest to writing. Short sentences draw attention, while longer sentences provide detail and explanation. Together, they create a dynamic and engaging style. For example, "The rainforest is dying. It is our fault. We must act." This short sequence is dramatic. Now compare: "The rainforest is facing destruction due to unchecked human activity and if urgent action is not taken, the consequences will be irreversible." This longer sentence adds detail and depth. When combined, such **variation keeps the reader engaged** and prevents monotony. Varied sentence lengths also help **emphasize important points**. A short sentence after a long one can deliver impact. They also accommodate **different purposes**—explanation, persuasion, storytelling—within one piece of writing. Mastering sentence variety makes writing more powerful, helps maintain reader interest and improves clarity and flow of expression.

5. **Clear, concise and well-organized paragraphs** are essential for effective communication. A clear paragraph has a well-defined main idea, stated through a topic sentence**. Conciseness** avoids unnecessary words, ensuring that only relevant information is shared. **Organization** refers to the logical arrangement of sentences, using transition words and a mix of sentence types to ensure readability. Such paragraphs make it easier for readers to understand and retain information. They also reflect the writer's ability to think clearly and present ideas logically.

For instance, in a professional email or essay, a disorganized paragraph might confuse the reader, but a well-structured one ensures the message is delivered accurately and effectively. Moreover, good paragraph writing builds trust with the audience, as it shows respect for their time and intelligence. It also makes the writing look polished and professional. A clear paragraph structure improves both written and spoken communication, making ideas more impactful and meaningful.

II. Higher Order Thinking Skills (HOTS)

1. Understanding **parts of speech** and **sentence structure** enables precise and effective communication, which in turn builds trust and rapport. When individuals use grammatically correct sentences with appropriate **nouns, verbs, adjectives and adverbs**, they express themselves clearly. This reduces misunderstandings and reflects careful thought, which others perceive as respectful and trustworthy. For example, using proper verbs shows action and responsibility— "I will submit the report"—while accurate adjectives and adverbs add clarity— "I urgently need your feedback." Proper sentence structure helps organize thoughts logically, which builds credibility. A well-structured declarative sentence, like "I value your opinion on this matter," shows confidence and respect. Understanding **sentence functions—imperative for requests, interrogative for questions and exclamatory for emotions**—ensures one's tone is appropriate. This is key in personal and professional relationships where misinterpretation can harm rapport. A command over language mechanics allows individuals to communicate not just with accuracy but with emotional intelligence, promoting mutual understanding, respect and stronger relationships.

2. When writing for a **younger audience**, the focus is on **simplicity, engagement and clarity.** Sentences should be short, direct and often include conversational language. Paragraphs should be brief, visually spaced out and include bullet points or headings for easy comprehension. Use of exclamatory and interrogative sentences can increase reader interaction, *e.g.,* "Did you know tigers can swim?"

   For **traditional newspapers**, the structure is more formal and informative. Sentences are complex, combining dependent and independent clauses to present nuanced arguments. Paragraphs are longer, focusing on analytical depth, with transitions like 'therefore', 'however' or 'in conclusion'. Passive voice may be used to maintain objectivity.

   In both cases, clarity is important, but the tone and depth change based on audience expectations. For young readers online, engagement and accessibility are priorities. For adult readers, especially in news contexts, logical flow and factual completeness take precedence.

3. While **clear and concise communication** is essential for avoiding misunderstandings, it can sometimes appear cold or overly formal if **emotional tone** is not considered. This happens when messages lack warmth, empathy or personal engagement—for example,

   "Submit the report by 5 p.m." is logical but may sound rude. A more human approach might be, "Could you please submit the report by 5 p.m.? Let me know if you need any help." In emotionally sensitive situations, such as giving feedback or consoling someone, carefully crafted and **empathetic communication** becomes crucial. Here, tone, choice of

words and sentence structure should show understanding and compassion, such as using phrases like, "I understand this is difficult," or, "You've done well so far." So, while clarity and brevity are important, they must be balanced with emotional intelligence. Effective communicators adapt their language to connect with others. Communication should not only transfer information; it should also build relationships.

III. Case-Based/Application-Based Questions

1. In this scenario, Riya presents ideas for a campaign but some team members feel confused and disengaged. This suggests a lack of clarity, structure and engagement in her communication. Firstly, she may not have clearly **outlined the goals of the meeting**, leading to uncertainty about its **purpose.** Secondly, she may not have **defined the specific roles** of each team member, which caused confusion regarding responsibilities. Thirdly, her message might not have been **concise or well-organized**, overwhelming listeners with ideas but not giving them actionable steps. Her failure to actively listen to or **invite feedback** during the meeting could have led to disengagement. Communication is a two-way process and without asking **clarifying questions** or summarizing key takeaways, the team likely missed important points. Riya also did not ensure **understanding through follow-up or reflection**, which is crucial for **effective communication.** She could have checked if everyone understood their tasks by asking questions or sending a summary. The lack of clarity, role definition and interactive engagement led to poor communication outcomes.

2. The most appropriate sentence function for outlining the goals of the campaign would be the **declarative sentence**. Declarative sentences are used to state facts, ideas or opinions in a straightforward manner. They are ideal for sharing important information clearly and confidently at the beginning of a meeting. For example, Riya could begin by saying, "The main goal of our campaign is to increase engagement among young audiences through creative content." This statement clearly communicates the purpose and sets a direction for the discussion. Using declarative sentences to start a meeting provides structure and helps participants understand the context. Unlike interrogative or exclamatory sentences, declarative statements do not demand a response or express emotions—they convey information. While imperative sentences can also be used later for assigning tasks, declarative ones are best suited for introducing topics.

3. **Passive voice** version of the sentence is as follows: "The ideas for the campaign were presented by Riya." Changing to passive voice shifts the focus from Riya (the doer) to the ideas (the object). This subtle change alters the tone and emphasis of the sentence. In **active voice**, "Riya presented her ideas for the campaign" highlights her as the central actor, making the statement more direct and engaging. It adds personal accountability and involvement. In contrast, the passive voice version sounds more formal and objective. It places emphasis on the action or the result—"the ideas"—rather than the individual. This can be useful in formal reports or when the doer is not as important as the action. However, excessive use of passive voice can make the writing look impersonal or detached. In team communication, especially in meetings, active voice is often preferred to keep the tone lively and direct. But in documentation or evaluation reports, passive voice may be suitable for neutrality and formality.

4. Riya could have improved **communication clarity** by using **structured and direct communication methods.** She could have begun the meeting with a clear **declarative statement** outlining the main goal of the campaign. Then, she could have **assigned roles** explicitly, using imperative sentences like, "Ravi, you will handle content scheduling," or, "Neha, please prepare graphic designs for the Instagram posts." Using **concise language** and avoiding vague terms would have prevented confusion. For example, rather than saying, "Let's all work together on visuals," she could say, "Amit will draft the storyboard and Priya will finalize the design." Riya could also have used transition phrases like 'next', 'in addition' and 'finally' to organize the **flow** of the meeting. Most importantly, she should have checked for understanding by asking clarifying questions or summarizing action points. A **follow-up email** summarizing each team member's responsibilities would have reinforced clarity. These strategies may have helped to ensure that the team has no doubts about expectations, timelines or roles, enhancing the campaign's efficiency.

5. Riya can use the following strategies to ensure **clear communication and follow-up:**

    1. **Set a Clear Agenda:** Share the meeting agenda in advance so team members know what to expect.
    2. **Use Clear and Concise Language:** Avoid jargon or vague instructions. Clearly state tasks using simple, direct sentences.
    3. **Assign Specific Roles:** Use names and action verbs to define responsibilities, *e.g.,* "Ajay will draft the post captions."
    4. **Summarize Key Points:** At the end of the meeting, recap what was discussed and decided.
    5. **Encourage Feedback:** Ask if anyone has doubts or needs clarification to ensure everyone is on the same page.
    6. **Send a Follow-up Email:** Include the meeting summary, action items, assigned roles and deadlines for future reference.
    7. **Use Visual Aids:** Charts or slides can help clarify complex tasks or timelines.
    8. **Schedule Check-ins:** Plan short review meetings or updates to monitor progress and offer support.

    Applying these strategies will help Riya foster better teamwork, minimize misunderstandings and ensure accountability in her projects.

Chapter 2: Self-Management Skills-IV

I. Subjective Type Questions

A. Short Answer Type Questions

1. **Intrinsic motivation** comes from within an individual and is driven by personal interest, enjoyment or inner satisfaction. For example, someone writing because they love the process is intrinsically motivated. In contrast, **extrinsic motivation** arises from external rewards or pressures. For example, a student studying hard to win a scholarship is extrinsically motivated. While intrinsic motivation leads to long-term engagement, extrinsic motivation may yield quicker results but can fade once the rewards disappear.
2. A **positive attitude** fosters optimism, resilience and a solution-focused mindset. It helps individuals handle stress, bounce back from setbacks, and maintain strong social connections. People with a positive attitude are more likely to engage in healthy behaviours, experience less mental distress, and build stronger professional and personal relationships. Over time, this mindset contributes to both physical wellbeing and sustained success by enhancing motivation, productivity and emotional balance.
3. **Result orientation** refers to focusing on achieving specific, measurable outcomes. It involves setting clear goals, tracking progress and taking action to meet those goals. This approach is crucial for effective goal setting as it prioritizes efficiency, accountability and tangible success. By using **SMART** goals—Specific, Measurable, Achievable, Relevant and Time-bound—individuals remain focused, motivated and can adapt their actions for continuous improvement and long-term achievement.
4. **'Cluster A'** personality disorders are characterized by odd, eccentric or suspicious behaviours. They include **Paranoid Personality Disorder** (PPD), where individuals are distrustful and interpret others' intentions as harmful; **Schizoid Personality Disorder** (SPD), marked by emotional detachment and social withdrawal; and **Schizotypal Personality Disorder** (STPD), involving eccentric behaviour, unusual beliefs and social difficulties. People with these disorders often struggle to form close relationships and may seem aloof or socially awkward.
5. **'Cluster B'** personality disorders involve dramatic, emotional and erratic behaviours. These include **Borderline Personality Disorder** (intense emotions, unstable relationships, impulsiveness), **Histrionic Personality Disorder** (attention-seeking, theatrical emotions), **Narcissistic Personality Disorder** (grandiosity, need for admiration, lack of empathy) and **Antisocial Personality Disorder** (deceitfulness, disregard for others, criminal behaviour). Individuals with 'Cluster B' disorders often struggle with self-control, emotional regulation and maintaining healthy relationships.
6. **'Cluster C'** personality disorders are marked by anxious and fearful behaviours. **Avoidant Personality Disorder** involves extreme shyness, fear of rejection and social inhibition. **Dependent Personality Disorder** (DPD) is characterized by excessive reliance on others for decision-making and fear of being alone. **Obsessive-Compulsive Personality Disorder** (OCPD) has markers like perfectionism, rigidity and a strong need for control. These individuals often experience chronic anxiety and have difficulty coping independently.

B. Long Answer Type Questions

1. **Self-management** is the ability to regulate one's emotions, thoughts and behaviours effectively. It involves taking responsibility for one's actions, setting goals and maintaining discipline. Core attributes include **autonomy, adaptability, responsibility, efficiency** and **leadership**. In one's personal life, self-management promotes better decision-making, emotional regulation and healthier relationships. Professionally, it enhances productivity, accountability and teamwork. For instance, individuals who manage their time well and adapt to change, thrive in the fast-paced work environments. Developing self-management skills is essential for achieving goals, handling stress and becoming a resilient, self-reliant individual capable of long-term success.

2. **Stress** is a natural response to perceived challenges but can lead to serious mental and physical issues when chronic. **Physically**, it can cause **fatigue, sleep disturbances, headaches** and even **cardiovascular disease**. **Mentally**, it contributes to **anxiety, depression** and difficulty concentrating. Effective stress management includes **deep breathing, physical activity, time management** and **healthy lifestyle choices.** Techniques like **mindfulness, journaling and seeking social support** help regulate emotions and reduce stress. Recognizing **personal stressors, setting boundaries** and **seeking professional help** when needed are also crucial. With consistent practice, individuals can turn stress into a motivating force for personal growth.

3. One common **myth** is that personality disorders are **untreatable**. This is not right. Many individuals improve significantly through **therapy, medication and support**. Another myth is that personality disorders are simply **character flaws or attention-seeking behaviour**. These disorders are complex mental health conditions influenced by biological, psychological and environmental factors. Assuming they stem from weakness or willpower failure is harmful. Misconceptions prevent affected individuals from seeking help**. Education, empathy and professional guidance** are key to managing these disorders. With consistent treatment and support, individuals can lead stable and fulfilling lives despite these challenges.

4. **Self-awareness** is understanding one's own **thoughts, emotions and behaviours**. It is foundational for emotional intelligence, decision-making and personal growth. Enhancing self-awareness involves **mindfulness practices, self-reflection, journaling, feedback from others and self-assessment tools.** For example, regular reflection on one's reactions helps identify strengths and weaknesses. Self-awareness fosters better communication, empathy and adaptability. It also allows individuals to align their goals with their values and make informed life choices. Without self-awareness, personal development remains superficial. In essence, knowing oneself is the first step towards making a meaningful change and achieving success.

5. Effective **stress-management techniques** include mindfulness, deep breathing, physical activity, time management, healthy lifestyle habits and seeking support.

   Mindfulness: Helps individuals stay grounded and reduces anxiety.

Deep breathing: Such exercises activate the body's relaxation response.

Physical activity: Releases endorphins and boosts one's mood.

Time management: Organizing tasks and setting realistic goals prevent getting overwhelmed.

Healthy lifestyle: Maintaining a lifestyle with adequate sleep, a balanced diet and avoiding addictions also supports stress reduction.

Seeking support: Support from friends or professionals can provide emotional relief.

These techniques, when practised consistently, improve resilience and overall wellbeing. They not only address stress symptoms but also empower individuals to handle future challenges more effectively.

6. The **SMART strategy** is a structured approach to goal setting: **Specific, Measurable, Achievable, Relevant and Time-bound.** It ensures goals are clearly defined and realistic. For example, instead of saying 'improve fitness', a SMART goal would be 'exercise 30 minutes every day for 3 months'. This clarity promotes focus and accountability. Measurable progress boosts motivation and achievable steps prevent discouragement. Relevant goals ensure alignment with personal values while time-bound deadlines create urgency. By following the SMART method, individuals can track performance, stay motivated and increase their chances of achieving meaningful and successful outcomes, both in life and on the career front.

7. **Overcoming personality disorders** involves a multifaceted approach. **Psychotherapy**, especially cognitive behavioural therapy, helps individuals recognize harmful patterns and develop healthier behaviours. **Medication** may be prescribed to manage symptoms like anxiety or mood swings, providing stability. **Self-management strategies,** such as mindfulness, journaling, regular routines and healthy lifestyle habits, support emotional regulation and stress reduction. Building **strong support networks** and setting **realistic goals** enhance recovery. **Education and acceptance** also play a key role. While personality disorders are chronic, this combination of professional treatment and self-care allows individuals to manage symptoms, improve relationships and lead fulfilling lives.

8. **Resilience** is the ability to bounce back from setbacks and adapt to challenges. It can be cultivated by maintaining a positive attitude, practising gratitude and learning from experiences. **Setting realistic goals**, breaking down problems into manageable steps and celebrating small wins, help build confidence. **Supportive social networks** and self-care activities like hobbies, exercise and mindfulness also strengthen resilience. A **positive mindset** encourages optimism, reduces stress and improves problem-solving. By focusing on solutions rather than problems and embracing challenges as growth opportunities, individuals can navigate adversity with strength and emerge stronger.

II. Higher Order Thinking Skills (HOTS)

1. There are multiple **stress-management techniques** such as **mindfulness, physical activity, time management, deep breathing** and **social support**. Their effectiveness

depends on context. For instance, mindfulness and meditation are excellent for emotional regulation and widely used in educational and professional settings. Physical activity reduces stress, making it ideal for adolescents and working professionals. Time management helps prevent burnout by organizing tasks. However, cultural norms impact preferences. In collectivist cultures like India, sharing with family or friends is more common and acceptable, whereas individualistic cultures may prefer solitude or professional therapy. For example, seeking help from elders or spiritual leaders may be preferred in traditional societies. Also, practices like yoga, rooted in Indian culture, may be more readily embraced in Eastern settings. While all strategies offer benefits, cultural alignment ensures acceptance and sustained use, which ultimately enhances emotional resilience and wellbeing.

2. **Self-awareness** allows individuals to recognize their strengths, weaknesses, emotions and behaviours, leading to better decision-making and relationships. In the chapter, **Maya Angelou's** life exemplifies how self-awareness fostered resilience and purpose. In one's professional life, self-awareness enables clearer goal setting and improved teamwork. Individuals can cultivate it through techniques such as mindfulness, journaling, self-reflection, feedback and emotional intelligence. However, challenges include fear of self-confrontation, denial or discomfort in receiving criticism. Developing self-awareness also requires consistent effort and openness to change, which can be mentally draining. For example, someone realizing they procrastinate under pressure must take responsibility and modify habits. Despite difficulties, cultivating self-awareness leads to growth, greater empathy and professional competence. It is essential for leadership, communication and achieving long-term success.

3. **Intrinsic motivation** arises from personal interest or internal satisfaction, while **extrinsic motivation** comes from external rewards like money, praise or recognition. Intrinsic motivation fosters long-term engagement, creativity and self-fulfilment. For example, Elon Musk's intrinsic passion for space fuels innovation. Extrinsic motivation drives short-term performance, as seen in students studying to earn high grades. Culturally, collectivist societies may emphasize extrinsic motivators like family approval, while individualistic cultures may prioritize intrinsic goals. For instance, a student in India might be motivated to excel to honour their family, whereas one in the US might pursue learning out of personal curiosity. Understanding this cultural nuance is critical in designing motivational strategies. A balanced approach—combining intrinsic values with meaningful extrinsic rewards—often yields the best long-term outcomes.

4. **Personality disorders** are complex conditions requiring a multifaceted treatment approach. **Psychotherapy** is effective in addressing maladaptive thought patterns and improving relationships. Its strength lies in its personalized nature, though it requires long-term commitment. **Medication** helps manage symptoms like anxiety or mood swings but does not treat the root cause. **Self-management strategies** like mindfulness, routine and goal setting empower individuals to take control and sustain progress. However, treatment must be tailored to each person's symptoms, severity and social context. Factors to consider include the individual's willingness to change, support systems and co-morbid conditions. Treatment outcomes can be measured through reduced symptoms, improved daily functioning, stable relationships and self-reported quality of life. **Regular assessments and feedback** ensure progress and allow for adjustments, making the recovery process more realistic and achievable.

III. Case-Based / Application-Based Questions

1. Smita shows intense emotional fluctuations, fear of abandonment, insecurity and unstable relationships—all hallmarks of a personality disorder. She experiences mood swings, doubts her abilities, and avoids closeness due to trust issues. These behaviours align with '**Cluster B' personality disorders**, particularly **Borderline Personality Disorder (BPD).** 'Cluster B' is marked by **dramatic, erratic and emotional behaviour**. BPD specifically involves unstable self-image, impulsivity and fear of abandonment. Smita's struggle to maintain relationships and regulate emotions indicates a high likelihood of BPD. Her professional challenges and personal withdrawal further validate this classification, highlighting the need for timely psychological intervention.

2. Smita's inability to manage stress and emotions likely causes **poor work performance** and **strained relationships**. At work, overwhelming emotions may lead to **missed deadlines**, **reduced productivity** and **conflict with colleagues**. Emotion-driven decisions can harm professional credibility. In personal life, **fear of abandonment and trust issues** push people away, resulting in loneliness and further emotional distress. Lack of emotional regulation can lead to **impulsive reactions and mood swings**, which may alienate others. In the long term, this cycle increases feelings of failure, worsening her self-image and leading to isolation. Without intervention, her wellbeing and professional growth will remain compromised.

3. Smita may benefit from a **combination of psychotherapy, medication** and **self-management.** Dialectical Behaviour Therapy (DBT) is especially effective for Borderline Personality Disorder. It helps regulate emotions, improve relationships and manage distress. Medication like mood stabilizers or anti-depressants can reduce emotional intensity and anxiety**. Self-management strategies,** such as **mindfulness, journaling and setting boundaries**, would support emotional awareness and reduce impulsiveness. Involving support networks like family or support groups can also foster healing. This holistic approach can empower Smita to understand her emotional patterns, build healthier relationships and regain confidence in both her personal and professional life.

4. **Self-awareness** is crucial for Smita's recovery. By recognizing her **emotional triggers, negative thought patterns and relationship behaviours,** she can begin to change them. Journaling, therapy sessions and mindfulness practices can help her observe her reactions without judgment. As Smita becomes more self-aware, she can identify what causes her emotional outbursts or trust issues, and work on resolving them. This awareness fosters emotional intelligence, allowing her to pause before reacting impulsively. Over time, Smita can build healthier coping mechanisms and make informed decisions. Cultivating self-awareness not only improves her relationships but also enhances her emotional resilience and personal growth.

5. Smita can adopt **several stress-management** and **emotion regulation strategies**. **Mindfulness** and **meditation** will help her stay present and reduce overthinking. **Deep breathing** during stressful moments can calm her nervous system. At work, **time management** and setting **realistic goals** can reduce overload. In her personal life, she can build a support network by staying connected with empathetic friends or family. **Journaling** emotions and reflecting on daily triggers may improve self-understanding. She should also seek **therapy** to learn coping skills and set emotional boundaries. Combining these strategies can stabilize her mood, improve relationships and boost her confidence, both at work and home.

Chapter 3: ICT Skills-IV

Subjective Type Questions

I. Unsolved Questions

A. Short Answer Type Questions

1.

Microsoft Excel	
(*a*)	It is a paid software.
(*b*)	It is compatible with Windows, macOS, iOS, Android; full mobile and web support.
(*c*)	It has advanced tools like Power Pivot, Power Query, etc.
(*d*)	It is suitable for professional, enterprise and collaborative environments.
(*e*)	It has strong integration with OneDrive, SharePoint and Teams for real-time collaboration.
(*f*)	Its file extension is .xlsx by default.

LibreOffice Calc	
(*a*)	It is a free and open-source software.
(*b*)	It is compatible with Windows, macOS, Linux; limited mobile access via add-ons.
(*c*)	It has advanced formula support, data analysis tools, charting capabilities.
(*d*)	It is suitable for general users, students and open-source environments.
(*e*)	It has limited cloud integration.
(*f*)	Its file extension is .ods by default.

2. Spreadsheets help analyze data effectively by allowing users to organize information in rows and columns, perform calculations using formulas and perform analysis and visualization through tools like sorting, filtering, pivot tables, graphs and charts.

For example, a school tracks student marks in a spreadsheet.

Teachers can calculate averages with AVERAGE(), filter by class or subject and use pivot tables and charts to compare performance.

3. **Sorting** helps arrange data (*e.g.,* alphabetically or numerically) to identify patterns easily.

Example: Sort book titles in a school library list to find a book quickly.

Filtering shows only the rows that match specific criteria, hiding others for focused analysis.

Example: Filter the Genre column to view only Fantasy books. These tools make data easier to manage and analyze.

4. Presentation software helps display information visually, making it ideal for business and education. Its key features include:

   (*a*) Customizable slides for organized content

   (*b*) Text, images and videos for better engagement

   (*c*) Transitions and animations for emphasis

   (*d*) Templates for quick and professional design

   (*e*) Collaboration tools for group work

B. Long Answer Type Questions

1. Cell referencing refers to accessing the value of a cell by its address in any formula or function. It refers or identifies the location of a cell in a worksheet. It is the behaviour of a cell address in the formula when it is copied from one cell to another cell.

   Absolute Cell Referencing: In this type of referencing, if a formula is moved or copied to another cell, the cell address in the formula will not change. This is done by dollar ($) preceding a symbol in front of the column name as well as the row number. Once the cell address is made absolute, it will remain constant or unchanged even if the formula containing absolute cell address is dragged to other rows and columns in the worksheet.

   For example, F5 = E5-(E5*G1)/100.

   Relative Cell Referencing: By default, spreadsheet applications use relative cell referencing. As the word relative means that which keeps on changing, thus, if we move or copy a formula to another cell in relative cell referencing, the cell addresses will be changed accordingly in the formula.

   For example, D5 = B5*C5

2. **SUM():** It is the most extensively used function in Calc. It is used for calculating the total of the values displayed in the specified range or cells.

   Its syntax is:

   =SUM(value1; value2; value3…value n)

   For example, =SUM(20;30;50) will display the output as 100.

   Alternatively, we can also use this syntax: =SUM(start-celladdress: last-celladdress) =SUM(B3:B9); this will calculate and display the total of all values present in the cell range B3 to B9.

   AVERAGE(): It is used for calculating the average (mean) of a cell range or the specified value.

   Its syntax is:

   =AVERAGE(value1; value2; value3…value n)

For example, =AVERAGE(10;20;30) will display the output as 20. Alternatively, =AVERAGE(start-celladdress: last-celladdress)

=AVERAGE(C2:C8); this will calculate and display the average of all values present in the cell range C2 to C8.

The SUM() and AVERAGE() functions are useful tools that help in analyzing numerical data more effectively.

These functions are helpful because they:

(*a*) Make large sets of data easier to understand.

(*b*) Save time by doing calculations automatically.

(*c*) Help us draw conclusions and make decisions based on the results.

(*d*) Help in understanding the data clearly.

(*e*) Reduce the chances of error in calculations.

3. The steps to create a presentation using LibreOffice Calc are as follows:

(*a*) Open LibreOffice Impress from the application menu.

(*b*) Choose a blank presentation or a pre–designed template that suits the theme.

(*c*) Insert new slides and choose appropriate layouts (title slide, content, images, etc.)

(*d*) Add text, images and other media to the slides by using the toolbar options.

(*e*) Select transitions between slides for smoother presentation flow.

(*f*) Animate text, images or other elements on the slides to make the content more engaging.

(*g*) Proofread the slides, check formatting and adjust contents.

(*h*) Save the presentation in the desired format (.odp).

In LibreOffice Impress, applying slide layouts helps us structure the content on the slides, like placing titles, bullet points, images and other elements in predefined positions. We can apply slide layouts in various ways:

(*a*) Using Sidebar Pane

(*b*) Using Slides Pane

(*c*) Using Slide Layout Menu

In LibreOffice Impress, formatting of slides can be done on various elements of the slide such as:

(*a*) Formatting text – Font Name, Font Size and Font Color

(*b*) Highlighting text – Bold, Italic and Underline

(*c*) Aligning text – Left, Center, Right and Justified

(*d*) Changing text – Text color

4. Conditional formatting is a tool in spreadsheet applications that lets you automatically change how cells look based on the data they contain. You can apply different colors, fonts or styles to highlight certain values.

Steps to Apply Conditional Formatting:

(*a*) Select the range of cells you want to format.

(*b*) Go to the Format menu and click on the Conditional option.

(*c*) Set a rule or condition (*e.g.,* "value is greater than 700").

(*d*) Choose a style (like background color or bold text).

(*e*) Click OK to apply.

An example depicting Financial Analysis:

Imagine you are checking monthly expenses in a spreadsheet. You want to see which months had expenses over ₹ 10000.

You can set a condition: If value > 10000 and then apply a format: Highlight the cell in red.

This helps you easily spot months with high spending and take necessary steps to control costs.

5. Transitions are the special effects used when changing from one slide to another in a presentation. They decide how the next slide appears on the screen, for example, Wipe, Bars, Wheel, etc. Animations are effects used to add movement to text, images or other objects on a slide. They allow us to make content appear, move or disappear in different ways, such as Appear, Fly in, Box, etc. We can add animations to make elements appear or move on the slide and add transitions to control how slides change during the presentation.

Transitions and animations enhance the effectiveness of a presentation in the following ways:

(*a*) They help keep the audience engaged by adding movement and variety.

(*b*) Animations keep the focus on key information step by step.

(*c*) Animations help in showing the content one part at a time, so it is easier to understand.

(*d*) Transitions help in making the presentation look smooth while moving between slides.

(*e*) They provide a professional look to the presentation.

6. Password protection in spreadsheets plays an important role in keeping our data safe and private. It prevents unauthorized users from opening, viewing or editing the contents of the spreadsheet. This is especially useful when working with confidential or sensitive information, such as financial records, student marks or business reports.

This feature is used:

(*a*) To prevent unauthorized access:

If a spreadsheet contains personal, financial or business data, adding a password ensures that only those who have the correct password can open or view it.

(*b*) To control editing rights:

Sometimes, we may want others to view our spreadsheet but not make changes. By protecting individual sheets with a password, we can stop users from editing specific data while still allowing them to see it.

(*c*) To maintain data accuracy:

In group work or team projects, sheet protection helps ensure that important formulas or cells are not accidentally modified or deleted by others.

7. A Pivot Table is a feature in spreadsheet software such as LibreOffice Calc that helps us summarize and analyze large sets of data easily. Instead of going through long lists of numbers, we can use a pivot table to quickly see totals, averages or comparisons in a neat tabular format.

Pivot Tables help in data analysis in the following ways:

(*a*) **Organize Big Data:** When we have lots of rows of information, a pivot table can arrange it in a clear and simple way.

(*b*) **Summarize Information:** We can instantly find out totals, counts or averages without using complex formulas.

(*c*) **Spot Patterns and Trends:** It becomes easier to compare data, such as which product sold the most or which region had the highest sales.

(*d*) **Save Time:** Instead of checking each row manually, pivot tables do the work for you in just a few clicks.

For example, we want to manage a list of sales:

Salesperson	Product	Region	Amount
Mehul	Laptop	South	₹ 500000
Priyaank	Hard Disk	South	₹ 300000
Ritansh	Hard Disk	North	₹ 200000
Puneet	Laptop	North	₹ 400000

With the help of a Pivot Table, we can perform the following:

(*a*) Analyze the total sales per region.

(*b*) Identify which salesperson sold the most.

(*c*) Compare the performance of each product.

8. Formatting Text is a key part of making presentations look clear, professional and visually appealing. When text is properly formatted, it becomes easier to read and understand, helping the audience stay focused on the content.

Changing the font, size and color affect the readability and impact of a presentation in the following ways:

(*a*) **Font Style:** Choosing the right font (like Arial or Times New Roman) improves clarity. Simple, readable fonts help the audience read quickly without straining their eyes.

(*b*) **Font Size:** Using an appropriate font size ensures that text is visible even from a distance. Larger sizes should be used for headings and slightly smaller sizes for bullet points or descriptions.

(*c*) **Font Color:** Using the right colors helps in highlighting key points and drawing attention. For example, using a bold color for titles or important words can make them stand out. However, the text color should also contrast well with the background for easy reading.

9. Google Sheets is a cloud-based spreadsheet tool that allows multiple people to work on the same file at the same time. This feature is called real-time collaboration and it plays a big role in improving team productivity.

The benefits of cloud-based software like Google Sheets for team productivity are as follows:

(*a*) **Work Together Anytime, Anywhere:** Team members can access the spreadsheet from different locations and devices, which means they don't have to be in the same place to work together.

(*b*) **Live Updates:** When one person makes a change, others can see it instantly. This avoids confusion and saves time spent on sending updated versions back and forth.

(*c*) **Better Communication:** Google Sheets allows users to leave comments and suggestions directly in the sheet, making it easy to discuss changes and give feedback.

(*d*) **Earlier Versions:** Every change is saved automatically. If something goes wrong, users can view or restore earlier versions easily.

10. The advantages of using templates in presentation software are as follows:

(*a*) Using templates saves time by providing ready-made slide designs, so users don't have to design everything from scratch.

(*b*) It gives a professional appearance as templates are well-designed and help create clean, visually appealing presentations without needing design skills.

(*c*) It provides consistency by maintaining the same fonts, colors and layouts across all slides, making the presentation look uniform and organized.

(*d*) A template is easy to customize as users can edit the template as per their needs such as changing text, images or colors while keeping the overall structure intact.

(*e*) Templates are suitable for various purposes and can be used for different types of presentations like business correspondence, localization, etc.

Templates save time because they come with pre-designed layouts, background styles and font settings. We don't have to start designing each slide from scratch—just choose a template and fill in the content. Templates improve consistency by keeping the same font style, color scheme and layout on all slides. This makes the presentation look neat, professional and easier for the audience to follow.

Chapter 4: Entrepreneurship Skills-IV

I. Unsolved Questions

A. Short Answer Type Questions

1. **Entrepreneurship** is the process of identifying opportunities, taking calculated risks and organizing resources to create and grow a business. In today's global economy, entrepreneurship **drives innovation, creates jobs** and **enhances economic growth.**

   Entrepreneurs help solve problems, introduce disruptive products and services, and contribute to competitiveness in a fast-changing market.

2. Successful entrepreneurs possess qualities like **innovation, risk-taking, vision** and **adaptability.** They are opportunity-seekers who can recognize gaps in the market and develop creative solutions. **Leadership, resilience** and **decision-making** skills help them manage teams and challenges effectively. **Financial management, networking and passion** drive sustainable growth. Their persistence ensures they learn from failures and continue striving for success.

3. **Technical entrepreneurs** use their technical expertise to create advanced products or services. For example, Elon Musk (Tesla, SpaceX) relies on deep tech knowledge. **Non- technical entrepreneurs**, on the other hand, use vision and business acumen rather than technical skills. An example is the women-led venture Lijjat Papad, which succeeded through cooperative efforts and business strategy without advanced technology.

4. **Bootstrapping** refers to starting a business using personal savings or revenues without external funding. **Venture capital** involves raising funds from investors in exchange for equity. Entrepreneurs may prefer bootstrapping in early stages for full control and flexibility. However, when scaling quickly or requiring substantial funds, venture capital is more suitable due to its higher funding capacity.

B. Long Answer Type Questions

1. **Creativity and intuition** are vital for entrepreneurs to **innovate, envision unique solutions** and **respond to dynamic situations.** Creativity allows them to develop novel products and marketing strategies, while intuition helps in decision-making under uncertainty. It is often guided by experience and instinct. However, successful ventures also rely on scientific aspects like data analysis, feasibility studies, market research and experimentation. These ensure that creative ideas are viable, scalable and market-fit. For instance, a creative fashion product needs to be tested for demand, pricing and production feasibility. Entrepreneurs combine artistic creativity with scientific thinking to balance vision with practicality. This synergy improves the chances of success, ensuring ideas are not only original but also profitable and easy to implement.

2. Entrepreneurs face **environmental barriers like regulatory constraints, poor infrastructure and market saturation**. For example, Airbnb had to adapt to legal restrictions in cities like New York. **Faulty planning can cause lack of direction and poor resource use.** Without a clear business plan, funding and growth become difficult. **Personal barriers include self-doubt, difficulty in building teams or managing stress.** Spanx founder Sara Blakely overcame self-doubt and lack of industry experience through persistence. To overcome these challenges, entrepreneurs must conduct proper research, build strong networks and seek mentorship. Government initiatives like Startup India and PM MUDRA Yojana help address external obstacles by providing funding, training and regulatory ease.

3. **Startups** are newly launched businesses focused on innovative solutions, rapid growth and scalability. Unlike traditional businesses that aim for stable growth in established markets, startups target unmet needs with disruptive products or services. Startups feature innovation, scalable models, high growth potential and adaptability. They often operate in uncertain markets with evolving customer demands, making them high-risk. Startups also require flexible structures, creative problem-solving and external funding. For instance, Flipkart started from a small flat but grew into a billion-dollar firm through adoption of innovation and technology. Startups succeed by embracing risk and pushing boundaries.

4. **Government initiatives** like **Startup India and PM MUDRA Yojana** provide critical support to Indian startups. Startup India offers **tax benefits, simplified compliance** and **funding access** through schemes like the **Fund of Funds**. It also promotes **incubation**, **mentorship and startup hubs**. PM MUDRA Yojana provides **micro-loans under categories like Shishu and Tarun,** enabling small entrepreneurs to meet capital needs without collateral. These schemes **tackle regulatory hurdles, funding gaps and infrastructural issues,** especially for startups in Tier-2/3 cities. They also **support skill-building and inclusion** through training and special schemes for women entrepreneurs, enhancing overall economic participation and innovation.

5. **Opportunity identification** involves spotting unmet needs or inefficiencies in the market. Entrepreneurs recognize these through **research, observation and understanding consumer pain points.** They analyze **trends, feedback and market gaps.** For instance, Ajay saw elderly people struggling with grocery access and created a delivery service tailored to them. After identifying an opportunity, entrepreneurs develop business plans, innovate solutions, test the product and launch with targeted marketing. They also develop **strategies based on feedback**. Recognizing the right opportunity and acting on it in good time is a major driver of startup success.

6. **Interpersonal skills** help entrepreneurs build strong relationships with stakeholders including customers, team members and investors. **Good communication** fosters trust and clarity. **Negotiation** ensures win-win deals with partners or suppliers. **Networking** expands access to **opportunities, funding and advice**. Entrepreneurs with strong interpersonal abilities can resolve conflicts, inspire teams and secure collaborations. These skills are vital to attracting loyal customers, retaining talent and navigating competitive markets. Building positive interpersonal relationships sustains business growth through partnerships and trust.

7. **Risk-taking** is essential in entrepreneurship as it involves venturing into **new ideas with uncertainty.** However, successful entrepreneurs are not reckless—they take **calculated risks**. They **assess the market, study competitors and plan for contingencies**. Balancing risk involves using data, feedback and planning to avoid unnecessary losses while pursuing innovation. Entrepreneurs can maintain sustainability by diversifying offerings, maintaining reserves and adapting quickly. Thus, risk-taking combined with strategy drives innovation without compromising the venture's future.

II. Case-based/Application-based Questions

1. Identifying Opportunities – Ajay's Case

(*a*) Ajay identified the opportunity to assist elderly people in accessing groceries and technology. This is important because successful entrepreneurs solve real-world problems by identifying underserved markets. His idea combines service delivery and tech assistance, creating a niche with social impact.

(*b*) To stay relevant, Ajay should collect regular customer feedback, adapt features (like voice assistance or phone orders) and update offerings based on needs. He can partner with local stores or NGOs to expand reach.

(*c*) Risks include lack of adoption, operational issues or financial losses. He can mitigate these by piloting the service, securing early funding and training customer-friendly staff. His model can scale with strong marketing and tech integration.

2. Innovation and Adaptability – Mira's Case

(*a*) Mira displayed adaptability by shifting from luxury to eco-friendly fashion after analyzing market demand. Her ability to pivot shows that entrepreneurs must respond to customer needs.

(*b*) Adaptability is the key in dynamic markets like fashion, where trends change quickly. Entrepreneurs who adjust strategies survive longer and grow faster.

(*c*) To sustain growth, Mira should conduct periodic market research, introduce new eco-products, build customer loyalty and use social media for marketing. Partnering with eco-conscious influencers and offering customizations can also boost visibility. Mira's case proves that innovation and flexibility ensure survival and success in a competitive space.

3. Vikram's Risk Management Approach

(*a*) Vikram demonstrated calculated risk-taking by identifying a niche market—vegan, gluten-free and organic food, which is currently underserved in his city. This targeted approach reduces the intensity of direct competition while attracting a specific customer base seeking healthy food options. Niche targeting allows entrepreneurs to stand out and serve unmet needs, minimizing the risk of business failure in a saturated market.

(*b*) Apart from competition, Vikram may face risks like limited awareness, high initial costs or inconsistent demand. To address these, he can conduct market research, promote his food truck using social media and develop sampling strategies.

(*c*) His approach highlights the importance of calculated risk-taking—evaluating potential threats and rewards before acting. Rather than avoiding risk, successful entrepreneurs like Vikram embrace uncertainty with a strategic mindset. By narrowing his focus, aligning his offerings with market gaps and proactively mitigating foreseeable issues, Vikram increases his chances of establishing a viable and sustainable business. His actions reflect entrepreneurial qualities of innovation, adaptability and risk management.

4. Ankit's Social Enterprise Challenges and Solutions

(*a*) Ankit's social enterprise addresses a pressing social issue—lack of electricity in rural areas—while attempting to remain financially sustainable. His main challenge lies in balancing the mission of social impact with the need for consistent revenue generation. Social entrepreneurs often struggle with scaling operations due to funding limitations, logistical complexities and maintaining affordability for beneficiaries.

(*b*) To grow his enterprise while maintaining his mission, Ankit can adopt strategies such as tiered pricing models, cross-subsidization and forming strategic partnerships. Engaging local communities and employing micro-entrepreneurs for distribution can reduce costs and create local ownership.

(*c*) Government initiatives like Startup India, Atal Innovation Mission and credit schemes like MUDRA Yojana can support Ankit through funding, mentorship and incubation. Collaborating with NGOs or CSR programs can also help him scale the project to new regions. By aligning his business with government priorities and leveraging available resources, Ankit can overcome financial hurdles.

5. Rita's Adaptability and Resilience

Rita's entrepreneurial journey highlights the critical importance of adaptability and resilience. Despite facing regulatory challenges while launching her financial literacy app for underbanked communities, she successfully modified her business model to comply with regulations and continue operations. This demonstrates her capacity to adjust to external barriers, which is a key entrepreneurial trait.

Adaptability involves responding to changing environments by tweaking strategies, offerings or operations. Entrepreneurs like Rita understand that rigid business models can fail under pressure. Her willingness to evolve preserved her mission and kept her venture viable.

Resilience, on the other hand, helped Rita push forward despite obstacles. Setbacks are common in entrepreneurship and the ability to recover and persevere is essential. Rita's case reflects the entrepreneurial qualities of risk-taking, vision and persistence. Adaptability and resilience empower entrepreneurs to overcome failures, respond to market needs and pursue long-term sustainability.

6. Aman's Social Entrepreneurship and Scaling Strategy

Aman is a first-generation entrepreneur who launched a social enterprise focused on clean water solutions in rural areas. His focus on social impact defines his business as a social enterprise—a venture that addresses societal issues while aiming for financial

sustainability. Unlike traditional businesses, Aman's strategy prioritizes community well-being over immediate profits. This focus affects his strategy by requiring affordable pricing, community engagement and localized distribution. However, it presents scalability and funding challenges, common in mission-driven models. Limited capital and logistical difficulties in remote areas can hinder growth.

To scale effectively, Aman can explore government support like Startup India, PM MUDRA Yojana or credit guarantee schemes that offer collateral-free loans. Partnerships with NGOs, CSR-funded companies or water technology firms can also enhance his reach. By maintaining his mission and adopting hybrid revenue models (such as subsidizing costs via partnerships or selling to institutions), Aman can scale without compromising impact. His case illustrates the power of entrepreneurial innovation in solving real-world problems while using government schemes and partnerships for sustainability.

7. Megha's Strategic Adaptability and Growth

Megha's journey reflects a strong example of entrepreneurial **adaptability and strategic planning**. After launching an online marketplace for rural handmade products, she faced low initial sales. Instead of giving up, she adjusted her business plan and started conducting **market research**, analyzing competitors and refining her **marketing strategy**. She also built **partnerships** with local retailers which helped expand her market presence. These actions demonstrate three essential entrepreneurial qualities: **adaptability, initiative and networking**. Adaptability helped her refine offerings based on market demand. Market research allowed her to identify gaps and competitive strategies. Partnership-building created a supportive ecosystem for business growth.

Such strategic steps improved her venture's chances of success by responding to customer needs, building trust and reaching a broader audience. Megha's approach shows that entrepreneurship is not just about launching an idea but constantly evolving it in response to feedback and market conditions.

8. Ankit's Innovation and Differentiation Strategy

Ankit is planning to launch a food delivery service in a saturated market. His unique approach includes eco-friendly packaging and a subscription model, setting his business apart. This differentiation demonstrates innovation, a key driver for success in highly competitive markets. Innovation allows entrepreneurs to solve problems creatively, offer added value and disrupt existing norms. In Ankit's case, his sustainable packaging addresses environmental concerns while the subscription model ensures customer loyalty and recurring revenue.

To refine his strategy further, Ankit could:

(*a*) **Conduct market research** to validate demand.

(*b*) **Offer trials or discounts** to encourage subscriptions.

(*c*) Highlight his eco-values in **marketing campaigns.**

(*d*) **Partner** with local eco-friendly suppliers.

Differentiation, when combined with customer engagement and responsiveness, builds a strong brand identity. Ankit's strategy reflects modern entrepreneurial trends: sustainability, convenience and long-term value creation. His example shows how creative positioning and purpose-driven values help startups survive and thrive in competitive markets.

Chapter 5: Green Skills-IV

I. Unsolved Questions

A. Short Answer Type Questions

1. **Green jobs** are employment opportunities that contribute to environmental sustainability by reducing pollution, conserving natural resources and promoting renewable energy. These jobs span across sectors such as **agriculture, energy, construction and waste management**. Their significance lies in **addressing climate change, reducing carbon emissions and supporting ecological balance.** For example, jobs in solar panel installation and waste recycling not only help reduce environmental harm but also generate income and improve public health. Green jobs promote long-term sustainable growth and environmental protection.

2. Green jobs in the **renewable energy sector** play a vital role in cutting down greenhouse gas emissions by **replacing fossil fuels with clean sources like solar and wind energy**. **Solar panel installers, wind turbine technicians and renewable energy engineers** develop systems that produce electricity without harmful emissions. For instance, **India's National Solar Mission** has created thousands of jobs in solar installation and maintenance. These professionals help reduce reliance on coal or oil, resulting in cleaner air and a reduced carbon footprint.

3. **Waste management green jobs** include roles like **waste collectors, recycling plant workers and compost technicians.** These professionals ensure that waste is sorted, reused or turned into valuable resources, reducing landfill use and pollution. Recycling converts paper, plastic and metals into reusable products, saving raw materials and energy. Composting transforms organic waste into nutrient-rich soil, lowering methane emissions from dumps. Together, these practices minimize waste and promote a **circular economy** that benefits both the people and the planet.

4. **Water conservation green jobs involve hydrologists, irrigation planners and conservation workers** who design systems to manage water use sustainably. **Rainwater harvesting** collects and stores rain for reuse, reducing dependency on groundwater. **Efficient irrigation systems** like drip or sprinkler irrigation minimize water loss in agriculture. These technologies ensure more water reaches crops with less wastage. Such practices help preserve freshwater sources, support sustainable agriculture and generate employment in water management technologies.

B. Long Answer Type Questions

1. **Sustainable agriculture** is vital in green jobs as it supports food production without harming the environment. Practices like **organic farming, agroforestry and water conservation** help improve soil health, reduce pollution and increase biodiversity. Organic farming avoids synthetic fertilizers and pesticides, using natural methods like compost, crop rotation and biological pest control. This reduces groundwater contamination and greenhouse gas emissions. Green jobs in organic farming include

soil scientists, organic certification agents and farm workers trained in eco-friendly practices. These jobs promote healthier food, better land use and rural employment. Government initiatives like the National Mission for Sustainable Agriculture also promote sustainable techniques, enhancing job opportunities. Sustainable farming feeds the population responsibly while also nurturing the earth for future generations.

2. **Green jobs in transportation** aim to reduce carbon emissions, improve air quality and modernize mobility systems. **Electric vehicles** (EVs) reduce reliance on petrol and diesel, emitting little to no pollutants. Jobs in this field include **EV manufacturers, charging station technicians and battery recyclers**. **Shared mobility** like ride-sharing and public e-transport reduces the number of vehicles on roads, cutting traffic and emissions. These roles create employment in **IT support, fleet management and EV maintenance**. Government initiatives like the FAME scheme promote EV adoption and infrastructure, encouraging sustainable commuting. As urban areas grow, green transport jobs help build eco-friendly cities with cleaner air and reduced fossil fuel use, contributing to climate goals and public health improvement.

3. **Energy efficiency in construction** involves designing buildings that consume less energy through better insulation, lighting and appliances. Green jobs in this area include **energy auditors, architects and insulation experts**. **Retrofitting** is the process of upgrading old buildings with energy-efficient systems, such as **LED lighting, double-glazed windows and smart energy meters.** This reduces power consumption, lowers energy bills and minimizes carbon emissions. These jobs also help cities meet sustainability targets without demolishing existing structures. For example, retrofitting old schools or government buildings in India has created jobs while reducing their carbon footprint. Sustainable construction practices conserve resources and promote eco-friendly urban development.

4. **Solid waste management** promotes a **circular economy** by ensuring waste materials are reused, recycled or converted to energy instead of being dumped. Green jobs here include **waste sorters, composting experts and engineers at recycling plants.** Waste exchange programs involve one industry's waste becoming another's raw material, for example, paper mill rejects reused in production. Waste-to-energy technology converts non-recyclable waste into electricity using incineration or biogas systems. These jobs support efficient resource use and reduce environmental damage. For instance, waste-to-energy plants in Delhi have created technical jobs and reduced landfill pressure. This approach keeps materials in use longer, reducing extraction of raw materials and promoting sustainability.

5. **Green jobs** play a vital role in **ecosystem protection** by managing natural habitats and preserving biodiversity. **Conservationists** work to protect forests, wetlands and endangered species by conducting surveys, implementing policies and spreading awareness. **Restoration specialists** help rehabilitate damaged ecosystems by replanting native species, controlling invasive plants and restoring soil health. These professionals work with governments and NGOs to rebuild habitats affected by deforestation, pollution or climate change. These roles not only restore environmental balance but also build climate resilience, prevent natural disasters and secure resources for future generations.

6. **The National Solar Mission,** launched in 2010, is a flagship initiative of the Indian government aimed at promoting solar energy to reduce dependence on fossil fuels. It plays a critical role in the country's transition to clean and sustainable energy. The mission has significantly contributed to **renewable energy development** by increasing the capacity and **affordability of solar power.**

   NSM has led to the creation of numerous **green jobs** across various domains. These include **manufacturing of solar panels, their installation on rooftops and solar farms as well as ongoing maintenance work. Solar technicians, engineers, quality controllers and maintenance staff** have found meaningful employment through this initiative. The mission also supports **research and development in solar technology,** creating jobs in innovation and design. By reducing greenhouse gas emissions and fostering economic growth, the NSM aligns with India's commitment to environmental sustainability. It supports both ecological conservation and socio-economic development.

7. Green jobs in **agriculture and forestry** promote practices that maintain ecological balance and enhance biodiversity. These roles focus on methods that reduce environmental degradation while ensuring food security and rural livelihood.

   Agroforestry, which integrates trees and shrubs with crops and livestock, is a key example. It enhances soil fertility, supports diverse plant and animal species, and reduces carbon emissions. Professionals in this field design landscapes that balance productivity with conservation.

   Similarly, **sustainable livestock management** employs practices like rotational grazing and eco-friendly feed production. These reduce overgrazing, preserve grasslands and cut methane emissions. Jobs in this domain include pasture managers and animal welfare specialists who ensure ethical and environmentally-sound animal farming.

   These green jobs also involve organic farming, soil conservation and water management—all supported by initiatives like the **National Mission for Sustainable Agriculture (NMSA).** By focusing on nature-friendly approaches, green jobs in agriculture and forestry help combat climate change, regenerate ecosystems and protect native species, contributing to a more resilient and biodiverse environment.

8. Government initiatives like the **Swachh Bharat Mission** and the **Green Skill Development Program** have significantly contributed to the growth of green jobs in India. The **Swachh Bharat Mission**, launched in 2014, promotes sanitation and waste management. It has created employment in **waste collection, segregation, composting, recycling and waste-to-energy projects**. This initiative has improved public health and hygiene while offering sustainable job opportunities in urban and rural areas. The **Green Skill Development Program**, initiated by the Ministry of Environment, trains youth in skills related to renewable energy, biodiversity conservation, pollution control and environmental monitoring. This enhances their employability in **emerging green sectors**. The program supports India's transition

to a green economy by building a workforce capable of handling climate-friendly technologies and practices. Together, these initiatives strengthen the foundation for sustainable development by combining environmental goals with job creation. They support India's ecological objectives while also empowering communities with the skills and opportunities needed for a greener future.

II. Case-based/Application-based Questions

1. As a **water resource specialist**, I would introduce **green job opportunities** focusing on sustainable water use and modern irrigation technologies. First, I would conduct a **water audit** to understand the local consumption and wastage. Then, I would implement **drip and sprinkler irrigation systems**, which minimize water loss and improve crop yield. Green jobs would be created in areas such as **system installation, maintenance and farmer training**. **Rainwater harvesting and check dam construction** can also be promoted, offering employment to local workers and engineers. These solutions conserve water, boost productivity and generate rural employment. **Partnering with government schemes like Jal Shakti Abhiyan** can further enhance impact. By empowering the community through training and employment in sustainable practices, water security and agricultural resilience can be improved while promoting green livelihoods.

2. To manage e-waste sustainably, I would establish an **e-waste recycling** and **refurbishment initiative**. This would create green jobs in **collection, sorting, dismantling, refurbishing and recycling electronic components.** Trained technicians would safely remove hazardous parts such as batteries and circuit boards to prevent environmental contamination. Usable parts could be salvaged and reused, while metals like copper and gold can be extracted and resold. Refurbished devices can be donated or resold at low cost, reducing waste and promoting digital inclusion. **Green jobs** like **e-waste handlers, electronics refurbishers and compliance officers** would become necessary. **Public awareness campaigns** and **partnerships with local NGOs** and schools would help in proper collection. Government compliance through **E-Waste Management Rules** and establishing links with certified recycling plants would ensure safety and be legal. This approach would not only reduce environmental damage but also turn waste into economic opportunity.

3. As a policymaker, I would promote green jobs by implementing the transition of the city's **transport system** towards electric and shared mobility. First, we would introduce financial incentives under schemes like FAME-II for electric vehicles (EVs). This would create jobs in EV manufacturing, assembly, charging infrastructure and battery recycling. We would expand **metro and electric bus fleets**, employing drivers, engineers and maintenance personnel. **Shared mobility platforms** like bike-sharing and carpool apps would be supported, generating roles in tech development, logistics and operations. Installing **solar-powered charging** stations and retrofitting public transport with clean energy systems would further reduce emissions. **Green training programs** would prepare the workforce with necessary skills. **Public awareness campaigns** would promote eco-friendly commuting. These initiatives would not only reduce vehicular emissions but also provide sustainable employment, helping the city transition towards a low-carbon economy.

4. To **minimize waste**, I would suggest implementing a **circular production model** where resources are reused efficiently. First, **quality control engineers** can monitor and adjust production processes to minimize defects, thereby reducing material waste. Introducing **automated monitoring systems** helps detect errors early, preventing unnecessary wastage. Materials that are slightly damaged or unused can be **repurposed** or sold through a waste exchange program to other industries. For example, plastic scraps can be melted and reused in new batches. Establishing an in-house recycling unit will allow reprocessing of rejected items. **Green job roles like quality analysts, sustainability officers, waste audit experts and recycling technicians** would be needed. Employee training on resource optimization and zero-waste manufacturing techniques would also be introduced. These steps would not only reduce environmental harm but also improve cost-efficiency and strengthen the company's commitment to sustainability.

Subject-Specific Skills

Chapter 1: Python Programming–II

Short Answer Type Questions

1.
- dtype shows the data type of array elements (*e.g.*, int, float), which is vital for consistency and performing suitable operations.
- shape gives the dimensions as a tuple, revealing how data is organized.
- size returns the total number of elements in the array. These attributes help in understanding the structure and type of numerical data, ensuring correct analysis and efficient memory use.

2. Indexing refers to retrieving a single element using its position, *e.g.*, arr[2] yields the third element. Slicing extracts a range of elements, *e.g.*, arr[1:4] gives elements from index 1 to 3. Indexing is for specific access, while slicing gets continuous subarrays—useful for focused data retrieval and manipulation.

3. Broadcasting lets NumPy perform arithmetic on arrays of different shapes. If a 1D array [1] is added to a 3 × 3 array, NumPy stretches the 1D array to match the 3 × 3 shape.

Example:

```
a = np.array([[0.0, 0.0, 0.0],
              [10.0, 10.0, 10.0],
              [20.0, 20.0, 20.0],
              [30.0, 30.0, 30.0]])
b = np.array([1.0, 2.0, 3.0])
print(a + b)
```

Here, array b is broadcast across each row of array a. The shape of b is (3,), which matches the number of columns in a.

4.
1. **head(n):** Returns the first n rows, giving a quick dataset preview.
2. **info():** Displays summary info about the DataFrame, including column types and missing values.
3. **describe():** Provides statistical summaries (mean, count, std, etc.).

These functions help understand data structure and contents quickly after import.

5. A Series is a one-dimensional labelled array; a DataFrame is two-dimensional, akin to a table.

- **Series:** Use for time series data like stock prices over time.
- **DataFrame:** Use for tabular datasets, *e.g.*, students' marks across subjects. DataFrames support more complex data manipulation with multiple columns.

6. Handling missing data is crucial as it ensures accuracy and prevents errors in analysis.

- To remove: Use dropna() to delete rows with missing values.
- To fill: Use fillna(value) to replace missing values with a specified value (*e.g.*, zero or the mean). Both maintain data integrity for reliable insights.

Long Answer Type Questions

1. NumPy arrays can be created in several ways:

1. From a Python list:

```
import numpy as np
arr = np.array([1,2,3])
```

This creates a 1D array.

2. Using arange() for sequences:

```
arr = np.arange(0,10,2)
```

Creates [0, 2, 4, 6, 8]

3. Using zeroes() :

```
np.zeros((2,3))
```

Gives a 2 × 3 array of zeros.

Each approach is suited for quickly initializing arrays for computation.

2. Vectorization enables operations on entire arrays without explicit Python loops.

For example,

```
arr = np.array([1,2,3])
result = arr * 2
```

It multiplies all elements at once. Unlike loops, which process one element at a time, vectorization uses optimized C code underneath, making computations much faster and more concise, crucial for large datasets in scientific analysis.

3. Steps:

1. Import data using libraries like Pandas.
2. Clean and prepare data (handle missing values).

3. Use features (X) and labels (y) for regression.
4. Split data into train and test sets.
5. Use LinearRegression from sklearn to fit the model.
6. Predict and evaluate results.

The slope represents the rate of change of Y with respect to X. The intercept is the value of Y when X = 0, defining where the line crosses the Y-axis.

4. (*a*) **From a list of dictionaries:**

```
import pandas as pd
data = [{'a':10, 'b':20}, {'a':5, 'b':10, 'c':20}]
df = pd.DataFrame(data)
```

The DataFrame has columns 'a', 'b', 'c', filling missing values with NaN.

(*b*) **From a NumPy array:**

```
import numpy as np
arr = np.array([[90,100,110,120],[50,60,70,80]])
df = pd.DataFrame(arr, columns=['A','B','C','D'])
```

Results in a 2 × 4 DataFrame labelled A–D.

5. Aggregation functions summarize many elements:

1. **sum():** Adds elements, *e.g.*, arr.sum().
2. **mean():** Calculates average, *e.g.*, arr.mean().
3. **min():** Finds minimum value, *e.g.*, arr.min().
4. **max():** Finds maximum value, *e.g.*, arr.max(). For 2D arrays, you can use the axis parameter: arr.sum(axis=0) sums columns, axis=1 sums rows.

6. First, import the CSV:

```
import pandas as pd
df = pd.read_csv('students.csv')
```

Explore with df.head(), df.info(), and df.describe().

```
df.head()
df.info()
df.describe()
```

Modifying by sorting the values according to marks:

```
df_sorted = df.sort_values('marks', ascending=False)
```

Filter the values greater than 80:

```
filtered = df[df['marks'] > 80]
```

Save to a new CSV:

```
filtered.to_csv('filtered_students.csv', index=False)
```

This efficiently prepares, modifies, and stores analysis-ready data. The new csv file contains the information of students having marks greater than 80.

Case-based/HOTS Questions

1.
```
import numpy as np
a = np.array([10, 20, 30, 40, 50])
b = np.array([2, 4, 6, 8, 10])
# Add both arrays
add_result = a + b                # [12, 24, 36, 48, 60]
# Multiply element-wise
mult_result = a * b               # [20, 80, 180, 320, 500]
# Square each element of a
square_a = a ** 2                 # [100, 400, 900, 1600, 2500]
# Mean of b
mean_b = b.mean()                 # 6.0
```

NumPy supports element-wise operations without writing explicit loops, resulting in concise, readable and efficient code. It uses optimized C-based computations, offering faster processing and less memory usage compared to traditional Python lists, especially for large datasets or scientific calculations.

2.
```
import numpy as np
import pandas as pd
data = {
    'Name': ['Ankit', 'Bhavna', 'Chetan', 'Diya', 'Esha'],
    'Subject': ['Math', 'Science', 'English', 'Math', 'English'],
    'Marks': [88, 75, np.nan, 92, 81],
    'City': ['Delhi', 'Mumbai', 'Chennai', np.nan, 'Kolkata']
```

```
}
df = pd.DataFrame(data)
# Identify missing values
missing = df.isnull()
# Fill missing marks with mean
mean_marks = df['Marks'].mean()
df['Marks'].fillna(mean_marks, inplace=True)
# Fill missing city with 'Unknown'
df['City'].fillna('Unknown', inplace=True)
# Display modified DataFrame
print(df)
```

Justification:

In small datasets, dropping rows with missing values can cause significant data loss and bias results. Filling missing values preserves most of the original information, allowing for accurate and meaningful analysis without discarding valuable data points.

3.

```
import numpy as np
temps = np.array([[22, 25, 30], [24, 28, 35], [23, 27, 32]])
# Maximum temperature recorded
max_temp = temps.max()                    # 35
# Average temperature for each time slot (column-wise)
avg_temp_per_time = temps.mean(axis=0)    # [23.0, 26.666..., 32.333...]
# Extract temperatures > 30°C
above_30 = temps[temps > 30]              # [35, 32]
# Reshape to 1D and sort
reshaped_sorted = np.sort(temps.flatten()) # [22 23 24 25 27 28 30 32 35]
```

Explanation:

NumPy enables easy matrix operations, including finding max, means, filtering, reshaping, and sorting using concise code with built-in functions. This avoids manual looping and is highly efficient and reliable in scientific computing and real-time data analysis.

Image-based Questions

1. DataFrame Data Issues and Cleaning

   (*a*) Two data issues present:

   1. **Missing Values:** Several 'Age', 'Salary', and 'Department' cells are blank (NaN/---).
   2. **Inconsistent Data Entry:** The column names or entries may have extra spaces or mixed cases.

   (*b*)
```
import pandas as pd

# (i) Load the CSV (assuming filename 'employees.csv')

df = pd.read_csv('employees.csv')

# (ii) Clean column names (remove spaces, standardize case)

df.columns = [col.strip().title() for col in df.columns]

# (iii) Replace missing 'Age' values with mean

df['Age'].fillna(df['Age'].mean(), inplace=True)
```

2. Linear Regression Line Parameters

   - **Parameter A:** Intercept (c) – the value of the response when explanatory variable is zero.
   - **Parameter B:** Slope (m) – indicates how much the response changes per unit change in explanatory variable.

Chapter 2: Data Science Methodology

Short Answer Type Questions

1. Accuracy measures the proportion of correct predictions made by a model out of all predictions. It is calculated as:

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

where TP = True Positives, TN = True Negatives, FP = False Positives, and FN = False Negatives.

In cases of imbalanced datasets, high accuracy may be misleading because the model might predict only the majority class correctly, ignoring the minority class entirely.

2.
- Analyze customer booking patterns to optimize flight routes for profitability and convenience.
- Predict maintenance needs using sensor data to reduce downtime and improve flight safety.

3. A training set is a collection of labelled data used to teach a machine learning model how to recognize patterns and relationships. It forms the basis for the model to learn and improve its prediction accuracy when exposed to new, unseen data.

4. A Capstone project is a comprehensive, practical project at the end of a course, bringing together knowledge and skills gained by solving real-world problems.

Examples:

(*i*) Developing a student marks prediction system.

(*ii*) Creating a chatbot for school helpdesk services.

5. Design Thinking is a user-centered approach to creative problem-solving, focusing on understanding user needs and iterative solutions. Its main stages are Empathize, Define, Ideate, Prototype, Test.

6. Empathize, Define, Ideate, Prototype Test (*Any four*).

7.
- Train-Test Split partitions the dataset once, while Cross-Validation splits it multiple times for thorough evaluation.
- Cross-Validation provides a better estimate of model performance as it tests the model on multiple unseen parts of the data, unlike a single test set in Train-Test Split.

8. Design Thinking is an iterative, solution-focused approach that involves deeply understanding users, redefining problems, and creating innovative solutions through stages like Empathize, Define, Ideate, Prototype and Test.

9. Train-Test Split Evaluation involves dividing the dataset into two parts: one to train the model and one to test its performance. This approach assesses how well the model generalizes to new, unseen data.

10.
- A train dataset is used to fit and build the model by learning from input-output examples.
- A test dataset (unseen by the model) is used to evaluate the accuracy and effectiveness of the model's predictions.

11. Cross-validation is a statistical technique used to assess how well a machine learning model generalizes to unseen data. It involves splitting the dataset into multiple subsets (folds). The model is trained on a portion of these folds and tested on the remaining fold, rotating which fold is used for testing in each iteration. This process is repeated, and performance metrics are averaged, providing a more robust evaluation and helping prevent overfitting. Every stage is independently executed with one-fold as testing, and remaining folds as training which ensures that no overfitting occurs

12. Scoping sets clear boundaries and objectives for an AI project, ensuring all stakeholders have a common understanding of what the project will achieve. It prevents scope creep, focuses resources and ensures the solution addresses the actual problem. Without clear scoping, projects may become unfocused and fail to deliver meaningful results.

Long Answer Questions

1. A Capstone project integrates concepts learned in a course through practical application. Students tackle real-life problems, conduct research, analyze data, and develop projects from start to finish. This process sharpens critical thinking, encourages teamwork and hones problem-solving abilities, preparing students for higher education or the workplace by giving them experience in tackling and solving open-ended, practical problems.

2. CRISP-DM refers to the Cross Industry Standard Process for Data Mining. Its main stages are: Business Understanding, Data Understanding, Data Preparation, Modelling, Evaluation, and Deployment. This structured approach provides clear steps and guidelines for managing a data project, ensuring systematic progress, comprehensive analysis, and alignment with business goals.

3. Problem decomposition involves breaking a complex problem into smaller, manageable components. This helps identify root causes, prioritize issues, and develop targeted solutions, making it easier to address each part effectively. In Design Thinking, it supports creative solutions and systematic progress, increasing the chances of solving the overall problem.

4.
- True Positive (TP): Model correctly predicts a positive class.
- False Positive (FP): Model incorrectly predicts positive for a negative case.
- True Negative (TN): Model correctly predicts a negative class.
- False Negative (FN): Model fails to predict positive for a positive case. Together, these categories in a confusion matrix help assess a model's strengths and errors, informing precision, recall, and overall accuracy analysis.

5. Precision measures the accuracy of positive predictions (TP/(TP+FP)), while recall measures the model's ability to identify all positive cases (TP/(TP+FN)). Precision is prioritized when the cost of false positives is high (*e.g.*, email spam), and recall is prioritized when missing positives is more serious (*e.g.*, disease detection).

6. Increasing precision often reduces recall, and vice versa, because being more selective increases the chances of missing some true positives. Achieving both at maximum is rare, as strictness in prediction reduces false positives (higher precision) but increases missed positives (lower recall). This trade-off must be balanced per application need.

7. The F1 score is the harmonic mean of precision and recall, providing a single metric to balance both. It is calculated as:

$$F1 = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

F1 is especially useful when class distribution is imbalanced or when both false positives and false negatives are important.

8. Log-Loss measures the performance of a classification model where the predicted output is a probability value between 0 and 1. It penalizes incorrect and overconfident predictions more heavily. Log-Loss is especially useful for probabilistic (soft) classification models used in binary or multi-class problems.

9. An ROC Curve plots the True Positive Rate (TPR) against the False Positive Rate (FPR) for various threshold values, showing the trade-off between sensitivity and specificity. The Area Under the Curve (AUC) quantifies performance; an AUC closer to 1 indicates a better model. This helps compare model performance independently of class imbalance.

10. Lowering the threshold increases the True Positive Rate (catching more positives) but may also increase False Positives. Raising the threshold decreases False Positives but may miss actual positives (lower True Positive Rate), thus impacting performance balance based on application requirements.

11. Class overlap occurs when instances of different classes share similar features, making them difficult to distinguish. High overlap reduces the model's classification accuracy, leading to more misclassifications and decreased overall reliability in predictions.

12. Threshold values are determined using performance metrics like ROC/AUC, precision-recall curves, and domain requirements. Factors include costs/risks of false positives and false negatives, class distribution, and desired balance between sensitivity and specificity in the given context.

13. Regression predicts continuous numerical values, while classification predicts discrete categories. As outputs differ (continuous vs. categorical), evaluation metrics differ: regression uses MAE, MSE, RMSE for errors in numbers, while classification uses accuracy, precision, recall for predicting correct classes.

14.

- MAE is the average of absolute differences; useful for measuring straightforward average error, *e.g.*, daily temperature prediction.
- MSE squares errors before averaging, highlighting larger errors; suitable for critical applications where big mistakes are costly, *e.g.*, flight delay prediction.
- RMSE is the square root of MSE, restoring units and emphasizing larger errors; used in house price predictions for interpretability.

15. • **False Positive:** A genuine transaction marked as fraud, causing inconvenience to the customer.

    • **False Negative:** A fraudulent transaction not detected by the model, resulting in possible financial loss to the institution and customer.

16. 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 dataset of about 630 tests and the resulting confusion matrix is as follows:

Confusion Matrix		**Reality**	
		Yes	No
Prediction	Yes	110	60
	No	50	410

Calculate:

- **Accuracy:** (110 + 410) / 630 = 520 / 630 ≈ 0.825
- **Precision:** 110 / (110 + 60) = 110 / 170 ≈ 0.647
- **Recall:** 110 / (110 + 50) = 110 / 160 = 0.687
- **Specificity:** 410 / (410 + 60) = 410 / 470 ≈ 0.872

17. The 'Design/Building the Model' step involves selecting suitable algorithms and developing a machine learning model based on prepared data. In this phase, data scientists choose appropriate modelling techniques (such as linear regression, decision trees or neural networks), set the parameters, and train the model using the training dataset. The objective is to enable the model to learn patterns and relationships from the data to make accurate predictions.

18. MSE stands for Mean Squared Error. MSE measures the average of the squares of the errors between the actual values and the predicted values produced by a regression model.

Formula:

$$\text{MSE} = \frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

where y_i = actual value, $\hat{y}_i$ = predicted value, and n = number of observations.

MSE is popular because it penalizes larger errors more heavily due to squaring. It helps to assess model accuracy objectively and guides the improvement of regression models.

19. **Step Identification:**

- **A:** Business Understanding
- **B:** Data Collection
- **C:** Modelling
- **D:** Deployment

Significance of Step A (Business Understanding):

This step focuses on identifying and defining the real-world business problem or objective. Clear business understanding ensures the data science process addresses the correct needs and sets the foundation for the project's direction.

Significance of Step B (Data Collection):

Data Collection involves gathering relevant, high-quality data required to solve the problem defined in the previous step. Thorough data collection is essential since accurate analysis and reliable results depend on having complete and meaningful datasets.

20. 1. **Data Integrity:** Testing data should be free from biases and representative of real-world scenarios.

2. **Evaluation Metrics:** Choose proper metrics (accuracy, F1 score, etc.) to measure performance.

3. **Overfitting Prevention:** Check that the model does not perform well only on test data but generalizes to new data.

4. **Documentation:** Clearly document testing procedures and outcomes for transparency and future reference.

Case-based/HOTS Questions

1. The CRISP-DM approach in healthcare starts with **Business Understanding**—defining goals, like predicting patient readmission. **Data Understanding** involves exploring clinical and EHR data. **Data Preparation** cleans data, handles missing values, and selects indicators such as age or lab results. **Modelling** applies algorithms (*e.g.*, logistic regression) to predict outcomes. **Evaluation** assesses model accuracy using metrics like recall. Finally, **Deployment** integrates the model into hospital systems for real-time patient risk monitoring, improving care outcomes.

2. The F1 score combines precision and recall into a single metric, balancing the need to detect fraudulent (recall) and accurately classify only the real frauds (precision). In fitness fraud detection, F1 is effective where both missing frauds and raising false alarms are problematic. However, if the cost of one type of error (*e.g.*, false negatives) is much higher than the other, relying solely on F1 may be misleading as it does not distinguish their individual impacts. In such cases, focus should be on precision or recall as more appropriate metrics.

3. With overlapping classes, you can improve performance by carefully setting the classification threshold—optimizing it for the best balance between precision and recall using ROC or Precision-Recall curves. Additional strategies include using advanced models with better feature extraction, creating new features, applying dimensionality reduction or ensemble methods like Random Forest. Collecting more quality data and proper preprocessing also help separate the classes more effectively.

4. For a smart city project (*e.g.*, optimizing traffic signals), decompose the problem into smaller tasks: data collection (traffic flow), analysis (peak hours) and solution design (dynamic signal timing). Follow Design Thinking as under:

1. **Empathize:** Interview citizens and traffic authorities.
2. **Define:** Specify issues like long waiting times.

3. **Ideate:** Brainstorm solutions—smart signals, mobile alerts.
4. **Prototype:** Develop a basic model or app.
5. **Test:** Get user feedback and iterate for improvements.

5. In imbalanced datasets (*e.g.*, rare frauds), high accuracy may simply reflect the majority class (*e.g.*, labelling all transactions as 'not fraud'). This is misleading as real frauds may go undetected. In such cases, we can use precision, recall, F1-score, confusion matrix, and ROC-AUC metrics to assess how well the model identifies minority classes and handles both types of errors.

6. In imbalanced datasets, increasing precision (fewer false positives) usually reduces recall (more false negatives), and vice versa. The decision on threshold and model selection depends on domain priorities—whether missing frauds (recall) or disrupting genuine users (precision) is worse. Adjusting thresholds based on business needs, and using the Precision-Recall curve, helps select the best compromise tailored to the problem.

7. The ROC (Receiver Operating Characteristic) curve plots true positive rate against false positive rate at different thresholds. The AUC (Area Under Curve) measures overall model ability—closer to 1 means better distinction between target and non-target customers. A high AUC shows the model is effective in identifying likely respondents, helping marketers optimize campaigns by targeting those most likely to respond while minimizing waste.

Image-based Questions

1. Confusion Matrix Metrics

Actual/Predicted	Spam	Non-spam
Spam	600	300
Non-spam	100	9000

- **Precision:**

  Precision = TP / (TP + FP) = 600 / (600 + 100) = 600/700 ≈ 0.857

- **Accuracy:**

  Accuracy = (TP + TN) / Total = (600 + 9000) / 10,000 = 9,600 / 10,000 = 0.96

- **F1 Score:**

  F1 = 2 × (Precision × Recall) / (Precision + Recall)

  Recall = TP / (TP + FN) = 600/(600 + 300) = 600/900 = 0.667

  F1 = 2 × (0.857 × 0.667)/(0.857 + 0.667) ≈ 0.75

2. Based on the ROC curve evaluation, Curve A is performing the best.

The closer an ROC curve is to the top-left corner of the plot, the better the model's performance. Curve A clearly hugs the top-left corner more closely than any other curve (B, C). This indicates that Curve A achieves a higher True Positive Rate (Sensitivity) for a given False Positive Rate, meaning it correctly identifies more positive cases while minimizing false alarms, signifying superior classification accuracy.

Chapter 3: Computer Vision—Making Machines See

Short Answer Type Questions

1. Object detection is more complex because, unlike image classification—which assigns a single label to an entire image—object detection must locate and classify multiple objects within the same image. For example, detecting both a car and a pedestrian in a street scene involves identifying their positions and types simultaneously.

2. Preprocessing enhances image quality and consistency, improving model performance. Noise reduction removes artifacts (*e.g.*, using filters to reduce blurriness), while normalization scales pixel values (*e.g.*, adjusting all pixel intensities from 0–255 to 0–1), ensuring uniformity for learning algorithms.

3. Computer vision interprets color numerically—typically using the RGB model—where each pixel is assigned red, green, and blue values between 0 and 255. Humans perceive color through complex biological processes. For instance, a computer might see an apple as (255,0,0) for red, unlike humans who interpret color subjectively.

4. Contextual understanding allows systems to interpret scenes accurately. Spatial context means recognizing the position of cars at an intersection, while temporal context refers to interpreting changes over time, such as a pedestrian beginning to cross the road when the signal turns green.

5. Noise introduces unwanted distortions, such as random spots or blurriness, degrading data quality. Noise reduction, such as applying Gaussian blurring, smoothens the image by averaging pixel values, making patterns and features clearer for analysis.

6. Edge detection identifies boundaries where image intensity changes sharply, useful for outlining shapes (like locating object edges). Texture analysis examines surface patterns (smooth, rough, or repetitive areas) to describe regions' properties, aiding in distinguishing different objects or materials.

7. Computer Vision significantly enhances medical imaging by:

    1. **Improving diagnostic accuracy and speed:** AI algorithms can detect subtle anomalies (*e.g.*, tumors, lesions) in scans much earlier and faster than human eyes, leading to earlier disease detection and treatment.

    2. **Automating repetitive tasks:** It automates image analysis, measurements (*e.g.*, tumor size), and classification, reducing radiologist workload and increasing efficiency.

        (*a*) Human vision adapts well to new situations, interpreting complex and ambiguous scenes using prior knowledge. Computer vision is faster and more accurate for repetitive tasks (like scanning faces at airports) but struggles with unexpected changes. Humans generalize from few examples, whereas computers require vast data. Significant use cases are facial recognition in security (computer vision excels in speed, but humans adapt better to disguise) and medical imaging (computers process scans quickly, but doctors interpret rare, unseen conditions with context-based reasoning).

(*b*) The pipeline begins with image acquisition (*e.g.*, cameras capturing street scenes). Next is preprocessing, including noise reduction and normalization. Feature extraction follows, detecting edges or textures. Segmentation or detection isolates objects (like vehicles). Classification assigns labels (car, pedestrian) and finally, decision-making occurs—such as an autonomous car deciding to brake for a pedestrian. Each stage ensures accurate and timely interpretation essential for real-world responses.

(*c*) Major ethical concerns include privacy invasion, unauthorized monitoring, and potential bias in identification. Ensuring responsible use involves deploying clear privacy policies, anonymizing collected data, regularly auditing algorithms for bias, securing consent where required and using surveillance only for legitimate purposes such as public safety.

(*d*) Autonomous vehicles use cameras, LiDAR and radar for image acquisition. High-resolution cameras capture every detail critical for recognizing traffic signals and pedestrians. For example, Google's self-driving cars employ multiple cameras for 360° vision. Challenges include adjusting for diverse lighting, varying weather and ensuring the devices process high-resolution images swiftly to enable safe real-time decisions.

(*e*) CNNs automatically extract hierarchical features from images. Early layers detect simple patterns like edges and colors; middle layers identify shapes and textures; deeper layers recognize complex objects, such as faces or vehicles. This progressive extraction allows for robust, high-level understanding essential for tasks like image classification and object detection.

(*f*) Traditional methods use handcrafted features and stepwise detection, while modern methods employ deep learning for end-to-end detection. R-CNN (Region-Based Convolutional Neural Networks) processes images by proposing regions and classifying them individually—accurate but slow. YOLO (You Only Look Once) views the image as a grid, predicting multiple objects at once—much faster and suited for real-time applications like surveillance and driver assistance systems, though sometimes less precise with overlapping objects.

Case-based/HOTS Questions

1.
- **Features and Techniques:** The system needs facial landmarks, pose estimation (body posture), movement speed and expression analysis. Techniques include using CNNs for facial analysis, skeletal tracking for posture and object detection for movement.
- **Challenges:** One, crowded environments can cause occlusions (hidden faces/bodies). Two, diverse lighting or unusual postures may affect detection accuracy.
- **Contextual Understanding:** By considering context (*e.g.*, time, location, passenger behavior patterns), the system can better distinguish between suspicious and normal actions, reducing false alerts.
- **Ethical Concern:** Privacy infringement is a key concern, as continuous monitoring may record sensitive personal data without explicit consent.

2. Computer Vision in Smart Agriculture

- **Feature Extraction Methods:** Color histograms for leaf discoloration, texture analysis for spotting rough or unhealthy areas and shape features for detecting abnormal plant growth.
- **Image Preprocessing:** Techniques like denoising, normalization and contrast enhancement remove visual noise and make disease symptoms stand out, improving model accuracy.
- **Segmentation and Object Detection:** Segmentation isolates diseased areas and object detection pinpoints specific affected plants, guiding targeted intervention.
- **Model Training:** The model is trained on labelled images, regularly updated with new samples of diseases and improved by feedback from agricultural experts and real-world validation.

3. Adversarial Attacks on Computer Vision Systems

- **Vulnerability:** Vision systems rely on patterns in pixel data. Small perturbations can fool them because deep models may be sensitive to features unnoticeable to humans.
- **Expanding Limitations:** Adversarial attacks show that deep learning can be brittle, lacking common sense or generalization and can make unsafe predictions.
- **Increasing Robustness:** Use of adversarial training (training on perturbed images), model regularization and input validation. Research into detection and defense mechanisms is also essential.
- **Human Response:** Unlike AI, humans recognize real-world context and ignore small visual changes, correctly identifying objects like stop signs, despite minor alterations.

4. Analytical HOTS – Decision-Making in Medical AI

- **Importance of Context:** Patient age, symptoms and history add vital background, letting AI differentiate between harmless and serious abnormalities, reducing false alarms.
- **Visual Features Limitation:** Solely relying on imaging may overlook patient-specific risks, leading to unnecessary anxiety or missed conditions.
- **Multi-modal Approach:** Integrate CV with electronic health records, lab results and medical history for comprehensive analysis and more accurate diagnosis.
- **Ethical Implications:** False positives or negatives can cause psychological harm, unnecessary treatments or missed care, raising issues of trust, consent and responsibility.

Image-based Questions

1. Image Processing Algorithms

- The result shows **Edge Detection** (extracting boundaries).
- **One algorithm:** Canny Edge Detection.
- **Purpose:** To identify object boundaries/features, simplifying images for further analysis.

2. Object Detection in Traffic Scene

(*a*) **Model Name:** YOLO (You Only Look Once) or SSD (Single Shot Detector).

(*b*) **Real-World Use:** Prevents accidents by identifying vehicles, pedestrians and traffic signals for autonomous driving.

(*c*) **Bounding Boxes:** Mark the location of objects. Inaccurate boxes can lead to missed detections or wrong classifications, which is risky in applications like self-driving cars.

Chapter 4: Data Mining with Orange

Short Answer Type Questions

1. Orange's visual programming lets users build analysis workflows by dragging and connecting widgets, requiring no coding knowledge. Each widget performs a specific task—loading data, preprocessing, modelling, or visualization. For instance, a market analyst can use Orange to visually analyze sales data, classify customer segments and display trends without writing code.

2. In Orange, classification predicts predefined categories using labelled data and learner widgets like Tree or Logistic Regression. Clustering finds natural groups in unlabelled data using clustering widgets (*e.g.*, K-Means). Classification workflows include labelled datasets and evaluation widgets, while clustering workflows use unsupervised clustering and visualizations to explore patterns.

3. Preprocessing ensures data quality by handling missing values, normalization and outlier removal. Widgets like Preprocess, Impute and Select Columns manage these tasks. If not properly preprocessed, analysis may yield misleading results due to noise, outliers or inconsistent values, affecting model accuracy and insights.

4. The "Test & Score" widget evaluates model performance using various sampling methods like cross-validation. It provides metrics such as accuracy, precision, recall, F1-score and area under the ROC curve, which are crucial for assessing how well a model generalizes and makes reliable predictions.

5. Orange supports interactivity by instantly propagating changes between connected widgets. For example, linking a File widget (data input) to a Scatter Plot (visualization) and a Data Table allows you to select points on the plot and view corresponding entries in the table, making analysis dynamic and interactive.

6. Educators can use student data (attendance, grades, activities) to predict performance. The workflow includes File (upload data), Preprocess (cleaning), Select Columns (feature choice), learners like Tree or Logistic Regression and Test & Score widgets. Insights may reveal key factors affecting performance, supporting targeted interventions.

7. CV analyzes and interprets images or visual data, using models for tasks like image classification or object detection. NLP processes and understands written or spoken language for tasks such as text classification or sentiment analysis. While CV handles visual content, NLP deals exclusively with text and speech.

Long Answer Type Questions

1. In Orange, data mining starts with collecting data (*e.g.*, purchase transactions from a supermarket basket), often using the File widget. Preprocessing occurs next via Preprocess and Select Columns widgets to clean and select relevant features. Data is then explored using visualizations like Scatter Plot and Pivot Table. Modelling widgets (*e.g.*, association rules or classifiers) find patterns or make predictions. Evaluate widgets (Test & Score, Confusion Matrix) assess model performance. Insights are communicated using visualization widgets (Bar Chart, Data Table), representing knowledge such as product associations or key buying trends.

2.
- **Data:** Widgets like File or Datasets load or import information.
- **Transform:** Widgets such as Preprocess handle cleaning, normalization and feature selection.
- **Visualize:** Scatter Plot, Box Plot, and Bar Chart display trends and patterns.
- **Model:** Learner widgets (Tree, SVM, KNN) train models for prediction or clustering.
- **Evaluate:** Test & Score, Confusion Matrix and ROC Analysis widgets validate model performance. Together, they create a pipeline where data flows from acquisition to analysis, enabling seamless, interactive insight generation.

3. Advantages of Orange include an intuitive visual interface, easy learning curve and rapid prototyping without coding. It is ideal for education, non-programmers and quick exploratory analysis. Limitations include less flexibility for custom algorithms and scalability for large datasets, compared to code-based tools like Scikit-learn which are highly customizable. Orange is preferred for teaching, demonstrations and when ease-of-use outweighs custom needs.

4. In Orange, image classification uses the Image Analytics add-on. The workflow: Import Images widget loads a flower image dataset, then Image Embedding widget converts images into features using pre-trained deep networks (*e.g.*, InceptionV3). Learner widgets like Random Forest or SVM build a classifier. Test & Score and Confusion Matrix widgets evaluate accuracy. This approach allows non-coders to classify images such as different flower species.

5. Document Embedding uses models like SBERT to convert text/documents into numerical vectors. The Neighbors widget computes similarity (*e.g.*, cosine similarity) between these vectors, retrieving semantically similar words or documents. This is used in plagiarism detection, recommendation systems, document clustering or discovering topic-related resources.

6. To predict customer churn in Orange, gather demographic and activity data with a churn label. Use File and Preprocess widgets for data cleaning and handling missing values. Model selection involves learners like Logistic Regression, Random Forest and SVM. Test & Score evaluates accuracy and other metrics. Visual widgets (Bar Chart, Data Table) help interpret results. Actionable insights include identifying at-risk customers and key churn predictors, enabling strategic retention measures.

Case-based/HOTS Questions

1. Research Question: Does higher attendance correlate with better academic performance?

2.
- **Data to Collect:** Attendance records, grades and participation metrics.
- **Widgets to Use:** File (load data), Preprocess (clean, impute missing values), Select Columns (choose relevant variables), Scatter Plot (visualize attendance vs. grades), Correlation widget (quantify relationship), Linear Regression learner (build predictive model) and Test & Score (evaluate).
- **Visualizations:** Scatter Plot with regression line, Correlation matrix, Box Plot of grades grouped by attendance quantiles.
- **Modelling:** Train with Linear Regression—predict grades from attendance.

3. Public datasets like UCI Student Performance or Kaggle's student info can be found.

4. Workflow Outline:

1. Load student dataset via File widget.
2. Clean data using Preprocess and Impute.
3. Select attendance and grades using Select Columns.
4. Visualize correlation with Scatter Plot and Correlation.
5. Model prediction with Linear Regression, evaluate with Test & Score; display results and insights explaining the relationship.

This process helps educators identify attendance as a factor in performance and plan interventions for students who require support.

Image-based Questions

1. (*a*) (*i*) **Image Embedding:** Converts images into numeric feature vectors suitable for ML models.

(*ii*) **Contribution:** Makes tasks like classification or face recognition possible by representing image characteristics numerically.

(*b*) **Pipeline Order:**

1. Data Collection
2. Preprocessing
3. Feature Extraction (Image Embedding)
4. Model Training
5. Testing and Scoring
6. Deployment

2.

- **Preprocess Widget:** Cleans, normalizes and prepares raw data.
- **Data Table Widget:** Presents data in tabular format for easy inspection and exploration.

Chapter 5: Introduction to Big Data and Data Analytics

Short Answer Type Questions

1. Traditional databases manage structured data with predefined schemas, suitable for moderate volumes and single-server setups. Big Data systems, however, handle massive, diverse, and quickly growing data from various sources. They use distributed architectures, enabling parallel processing and storage across clusters, ideal for handling variety, volume, and velocity demands.

2. Data governance ensures proper management, quality, security, and compliance of data in Big Data environments. It establishes policies and standards for data collection, storage, access, and usage. Effective data governance ensures data integrity, reduces risks of misuse or breaches and helps organizations derive trustworthy insights from their Big Data assets.

3. Semi-structured data has some organizational properties but not a fixed schema (*e.g.*, JSON, XML files); it mixes structured and unstructured elements. Unstructured data lacks any predefined structure and is more variable (*e.g.*, emails, images, free-form text).

   Example: Sensor logs are semi-structured; social media posts are unstructured.

4. Data locality means processing data close to where it is stored, reducing the need to transfer large data sets over networks. In Hadoop, this minimizes data movement, increases processing speed, and makes resource usage efficient, as computation is brought to the data rather than moving the data to computation.

5. - **Privacy invasion:** Collecting and analyzing personal data without consent may breach privacy.
   - **Data security:** Storing vast, sensitive data increases the risk of breaches or misuse.
   - **Discrimination/bias:** Improper data use can reinforce existing societal biases in decision-making and predictions.

6. A sliding window in stream mining is a moving window that focuses on analyzing only the most recent data points from a continuous stream. This approach is useful for detecting current patterns and trends, maintaining manageable data volumes and supporting real-time decisions in environments like sensor analytics or online monitoring.

Long Answer Type Questions

1. Big Data analytics enables small businesses to make better decisions by uncovering hidden patterns and customer trends. Benefits include improved marketing, personalized customer experiences, and operational efficiencies. However, the disadvantages involve high costs of infrastructure, tools and skilled personnel needed to manage and analyze large datasets. Limited expertise can lead to improper analyses or data misinterpretation. For small businesses, starting with focused data projects ensures benefits without significant overhead, provided investments and expected returns are balanced carefully.

2. Variability in Big Data refers to fluctuations in data flow and meaning, such as inconsistent formats, changing semantics or erratic arrival rates. For example, social media sentiment may vary drastically during a crisis, affecting trend analysis. If data analysis doesn't account for this variability, insights might be misleading or outdated, highlighting the need for robust, adaptable analytic methods to manage changing conditions.

3. Hadoop has a layered architecture. The Hadoop Distributed File System (HDFS) stores large volumes of data across multiple servers, ensuring fault tolerance and scalability. MapReduce is the processing engine that divides tasks into smaller subprocesses: the Map phase distributes work to nodes to process data in parallel and the Reduce phase aggregates the results. Together, HDFS and MapReduce enable reliable, efficient analysis of Big Data on distributed infrastructure.

4. Descriptive analytics summarizes past data to highlight patterns, such as monthly sales trends or average footfall. For instance, a retailer can use bar charts to visualize last year's sales by region. Diagnostic analytics explores why results occurred, identifying causal factors; for example, using correlation analysis to investigate why sales dropped in a specific quarter—perhaps discovering it was due to supply chain delays or ineffective campaigns.

5. Cloud storage allows organizations to store and access vast amounts of data without investing in expensive physical infrastructure. This supports Big Data analytics by providing scalability, flexibility and on-demand access. Benefits include lower upfront costs, improved collaboration across locations, enhanced disaster recovery options, and faster deployment of analytic solutions, empowering businesses to act rapidly on new insights.

6. Key skills include data management, programming (Python/Java), statistical analysis, familiarity with database and Big Data tools (Hadoop, Spark) and understanding data privacy and ethics. As Big Data evolves, expertise in machine learning, cloud services and real-time data processing is increasingly valuable. Communication skills are also essential for conveying insights effectively.

Case-based/HOTS Questions

1. **Case Study: Healthcare Optimization**

   A hospital chain can utilize Big Data analytics by integrating structured data (*e.g.*, patient registrations, historical arrivals), semi-structured sensor logs and unstructured doctors' notes. Descriptive analytics can highlight peak times and resource bottlenecks, while predictive analytics (*e.g.*, forecasting patient influx) enables better staff allocation. Text mining on doctors' notes uncovers common symptoms or conditions and real-time analysis from sensors helps monitor patient vitals, improving triage and prioritization. Patterns identified can support redesigning workflows, reducing wait times and improving ER efficiency.

2. **Ethical Dilemma: Targeted Advertising**

   Big Data analytics enhances personalized advertising but raises ethical issues around privacy, consent, and potential misuse. Customers may feel uncomfortable with how much personal data is collected and inferred. The company should be transparent about data practices, allow users to control what is collected (opt-in/out options), and anonymize sensitive data. Adhering to data protection laws and giving users clear explanations helps balance commercial gains and ethical responsibility.

3. **Future Trends:** Smart City Development

   Big Data analytics can process sensor and camera data to optimize traffic, adjust energy use, monitor pollution and enhance public safety. Examples include rerouting traffic in real time or predicting energy demand to prevent outages. Challenges include data security, privacy, system integration and equitable access. These can be addressed by implementing data governance, encryption, public policies for data use and inclusivity measures.

4. **Comparative Analysis: Choosing the Right Technology**
   - **Option A (Hadoop/MapReduce):** Suited for batch processing large, historical datasets. It is less responsive for real-time needs but cost-effective for periodic sentiment analysis.
   - **Option B (Spark):** Designed for real-time or near real-time stream processing, enabling quick sentiment detection from ongoing social media feeds.

     Recommendation: For customer sentiment analysis, Spark-based real-time processing is preferable if immediate insights are needed and resources are available. Hadoop is ideal for offline aggregation and analysis.

Image-based Questions

1. **7Vs of Big Data:**

   (*i*) **Volume** (*e.g.*, 200 zettabytes, 2.5 quintillion bytes/day)

   Challenge: Storing vast data cost-effectively.

   (*ii*) **Variety** (healthcare, social media, videos, sensors).

   Two big challenges: storing vast data cost-effectively and integrating disparate data types (structured, unstructured).

   (*iii*) **Velocity**

   (*e.g.*, real-time transactions, IoT data, social media updates)

   Challenge: Processing and analyzing data in real-time.

   (*iv*) **Veracity**

   (*e.g.*, sensor errors, misinformation, incomplete records)

   Challenge: Ensuring data accuracy, reliability, and consistency.

   (*v*) **Value**

   (*e.g.*, customer analytics, fraud detection, business intelligence)

   Challenge: Extracting meaningful, actionable insights from data.

   (*vi*) **Variability**

   (*e.g.*, changing data formats, inconsistent meanings, seasonal trends)

   Challenge: Handling data inconsistency and contextual shifts over time.

   (*vii*) **Visualization**

   (*e.g.*, dashboards, heatmaps, graphs for decision-making)

   Challenge: Presenting complex data clearly and understandably for stakeholders.

2. **Data Types:**
   - **Table:** Structured Data (organized in rows/columns).
   - **XML snippet:** Semi-Structured Data (tags, partial schema).
   - **Sentence about payment:** Unstructured Data (free-form text).

Chapter 6: Understanding Neural Networks

Short Answer Type Questions

1. Weights determine the influence each input has on a neuron's output; they are multiplied with input values. Bias is an additional constant added to the weighted sum, allowing the neuron to shift its activation function. Together, weights and bias help the neural network learn complex patterns by adjusting outputs during training.

2. An activation function introduces non-linearity into a neural network, enabling it to learn and solve complex tasks.

    - **Sigmoid:** Outputs values between 0 and 1, suitable for binary classification.
    - **ReLU (Rectified Linear Unit):** Outputs zero for negative values and the input itself for positive values, allowing fast and efficient training.

3. A step function is non-differentiable and has a constant gradient of zero almost everywhere, preventing gradient descent from adjusting weights properly. Gradient descent relies on the ability to compute derivatives, which is not possible with a step function, so learning cannot progress.

4. Overfitting occurs when a neural network learns patterns specific to the training data, including noise, rather than generalizing to unseen data. This leads to high accuracy on training data but poor performance on new, real-world data, making the model less reliable for predictions.

5. FNNs have one-way data flow, suitable for fixed-size inputs like image classification. RNNs have feedback loops, allowing them to process sequences, making them ideal for time-series data or language tasks, where previous inputs influence current output.

6. Deepfakes are realistic fake images, videos, or audios generated using advanced neural networks like GANs. They can manipulate appearances or voices, causing risks like spreading misinformation, damaging reputations, or compromising security by creating convincing fake media.

Long Answer Questions

1. Consider a cricket coach training a player to bat. First, the coach demonstrates a shot (input), and the player tries (forward propagation), resulting in a score (output). The coach compares the player's score to the desired result (error calculation). If the player misses, the coach gives feedback (backpropagation) on what to improve—adjust grip or stance—which corresponds to adjusting the neural network's weights and bias. The process repeats: each time the player (network) receives feedback, learns and performs better, eventually achieving accurate shots (better predictions).

2. A CNN typically consists of:

    - **Convolutional Layers:** Apply filters to extract features like edges or textures.
    - **Activation Layers:** Use functions like ReLU to introduce non-linearity.

- **Pooling Layers:** Reduce spatial dimensions (*e.g.*, max pooling), lowering computation and highlighting important features.
- **Fully Connected Layers:** Act as classifiers, combining extracted features for final prediction. Each layer transforms the data gradually, enabling the network to recognize complex patterns in images, such as objects or faces.

3. Explainable AI refers to systems whose decisions can be understood and interpreted by humans. In fields like healthcare or law enforcement, XAI ensures transparency and builds trust; decisions with life-altering consequences must be justifiable. XAI reveals the factors influencing predictions, supporting accountability, fairness and ethical compliance.

4. Neural networks power advances in healthcare, finance and communication, improving diagnostics, fraud detection and language translation. Negatives include job displacement, privacy concerns and misuse through deepfakes or biased decisions. Benefits can be maximized through ethical guidelines, continuous monitoring, unbiased data and transparent development to ensure responsible use and minimize harm.

5. Neural networks learn from training data, using its patterns to make predictions. Good training data is diverse, representative, accurate and free of bias or errors. High-quality data ensures the model generalizes well, avoids overfitting, and reflects real-world situations, leading to effective and fair outcomes.

6.
- **Supervised Learning:** Uses labelled data to predict outcomes; *e.g.*, image classification in medical diagnosis.
- **Unsupervised Learning:** Finds patterns in unlabelled data; *e.g.*, clustering customers in marketing.
- **Reinforcement Learning:** Learns through rewards and penalties; *e.g.*, training robots to navigate mazes or self-driving cars.

Case-based/HOTS Questions

1. **Credit Card Fraud Detection Using Neural Networks**

A company needs customer transaction data like amount, time, location, device used and expenditure patterns. Preprocessing steps include cleaning data, handling missing values, scaling numeric features and encoding categorical ones. A suitable architecture is a feedforward neural network or a more complex deep neural network. Model performance is evaluated using metrics like accuracy, precision, recall, F1-score and the confusion matrix to effectively identify fraud while minimizing false positives.

2. **Ethical Challenges in AI for Self-Driving Cars**

Ethical challenges include deciding between two harmful outcomes in unavoidable accident scenarios, ensuring fairness in decision-making and transparency of choices made by AI. Designers can address this by incorporating ethics guidelines, involving stakeholders in policy creation, continuously testing scenarios and building explainable models to justify decisions and improve trust.

3. Biased Medical Image Data in Hospitals

If the training data is biased toward a specific group, the neural network may perform poorly on other demographic groups, causing unfair or inaccurate diagnoses. To mitigate this, hospitals should collect diverse and representative data, perform bias audits, use fairness metrics and regularly retrain models on updated, balanced datasets to ensure equitable predictions.

4. Improving Cricket Performance Prediction with Neural Networks

To improve model accuracy, steps include collecting more and varied data (match conditions, player health, historical data), preprocessing (handling missing values, normalization), selecting relevant features, tuning model parameters and using cross-validation. Regular review of model predictions and integrating domain expertise also helps enhance performance.

Image-based Questions

1. Perceptron Diagram Matching

- **A:** Input Layer (*iii*)
- **B:** Weighted Inputs (*ii*)
- **C:** Summation Function (*v*)
- **D:** Activation Function (*i*)
- **E:** Output (*iv*)

(*a*) **Block C Formula:**

$$\sum_{i=1}^{n} (W_i \times X_i) + bias$$

(*b*) **Bias Purpose:** Allows the activation function threshold to shift, enabling better model flexibility.

2. Neural Network Layers (Image Classification)

(*a*) (*i*) **Layer A:** Input Layer; **B:** Hidden Layers; **C:** Output Layer.

(*ii*) **Role:** Each 'neuron' receives, transforms and transmits signals/features.

(*b*) **Process Flow:**

1. **Input:** Image is received.
2. **Hidden:** Features (edges, shapes) are extracted layer by layer.
3. **Output:** System determines the most likely class ("cat").

Chapter 7: Generative Artificial Intelligence

Short Answer Type Questions

1. Self-attention allows a transformer to consider all parts of a sentence at once, weighing the importance of each word relative to every other word. This parallel comparison helps the model capture relationships between distant words, making it effective for understanding the meaning of long, complex sentences.

2. First, large language models require significant computational resources for training and deployment, limiting their accessibility. Second, they can generate biased or factually incorrect content because their outputs depend on the data they were trained on. These limitations hinder responsible, broad and reliable use.

3. Parameter initialization sets the initial weights and biases before training begins, affecting how learning starts. Parameter updation adjusts these weights and biases after each training step using optimization algorithms like gradient descent, allowing the network to learn from data and improve performance as training progresses.

4. An LLM model is the underlying neural network trained to generate or analyze language, but it is not directly user-facing. An LLM product wraps the model in an application or service providing features like interfaces, security and integration for end-users or businesses.

5. Self-supervised learning uses vast amounts of unlabelled data, generating its own supervision signal from the data itself. This approach allows foundation models to leverage large data pools without the high cost and labour of human annotation, leading to more general and robust AI systems.

6. Generative models can create synthetic medical images to train diagnostic systems or generate language content in regional languages for educational materials. This assists in bridging resource gaps, enhancing accessibility and providing personalized learning and healthcare support.

Long Answer Type Questions

1. The transformer architecture relies on self-attention mechanisms, allowing it to process all elements in an input sequence simultaneously. This contrasts with RNNs and LSTMs, which process sequences step by step and maintain an internal state. Transformers can model long-range dependencies better, avoid issues like vanishing gradients and scale efficiently by processing in parallel. Unlike the sequential nature of RNNs/LSTMs, transformers are significantly faster and more capable of handling large datasets, making them the foundation for modern language models.

2. The earliest generative models, like Gaussian mixture models and basic neural networks, focused on modelling data distributions. Breakthroughs occurred in 2014 with Generative Adversarial Networks (GANs), which enabled realistic image and data generation. The introduction of Variational Autoencoders (VAEs) also advanced unsupervised representation learning. The biggest leap came with transformer-based models such as GPT, which enabled scalable, powerful text generation and multimodal capabilities, making generative AI central in modern applications.

3. Generative AI learns patterns and distributions in data through training. Probabilistic modelling lets it sample new data points based on learned probabilities. For example, a text generation model like GPT learns how words and phrases generally follow each other. Given a prompt, the model predicts the likelihood of each possible next word and selects one, producing human-like sentences by recognizing patterns and combining them probabilistically.

4. Foundation models are large-scale models pre-trained on vast datasets across domains using self-supervised learning. Unlike traditional task-specific models, foundation models provide generic capabilities that can be fine-tuned for specific applications. This shift accelerates AI development by reducing the need to train separate models from scratch for each task, enabling more efficient, scalable and adaptable AI solutions.

5. GPUs excel at parallel processing and can handle thousands of operations simultaneously, making them ideal for matrix-heavy computations in deep learning. Large AI models require massive computational power and memory bandwidth, where GPUs outperform CPUs, which process tasks mostly sequentially. Thus, GPUs drastically reduce training times, enabling practical development of large models, unlike CPUs that quickly become bottlenecks with such workloads.

6. Generative models learn to model the joint probability distribution of inputs and outputs, allowing them to generate new data (*e.g.*, GANs, VAEs, GPT). Discriminative models learn the boundaries between classes to classify data (*e.g.*, logistic regression, SVMs). Generative models are used for content creation (text, image, speech) and data synthesis, while discriminative models focus on prediction and classification tasks like spam detection or sentiment analysis.

Case-based/HOTS Questions

1. (*a*) A foundation model is most suitable because it can understand and generate multiple languages, adapt to various dialects and be fine-tuned for specific customer service scenarios, ensuring versatility and scalability.

   (*b*) The BharatGPT or IndicBERT foundation model is suitable, as it is specifically trained on Indian languages and can handle customer queries in multiple regional languages, ensuring coverage and cultural understanding.

2. (*a*) No, while more parameters can improve a model's ability to capture complex patterns, past a certain point they can lead to overfitting, inefficiency and increased resource consumption without proportional gains.

   (*b*) Increasing parameters raises computational costs and memory requirements, complicates training, may cause slower inference and increases the risk of overfitting and instability in model behavior.

3. (*a*) Personalized content generation: Generative AI can create tailored quizzes, teaching materials and feedback suited to each student's learning pace and style based on their progress.

   (*b*) First, data privacy and security for sensitive student information. Second, ensuring the generated content is accurate, free of bias, and age-appropriate.

4. (*a*) Generative AI uses deep learning models to synthesize realistic images, audio, and video, mimicking real personalities. This technology, such as GANs, can create convincing fake media by combining and altering existing footage.

(*b*) Technically, implement robust deepfake detection tools that flag manipulated content before sharing. Legally, enforce strict regulations and penalties for producing or distributing deceptive AI-generated media in sensitive contexts.

Image-based Questions

1. GAN Diagram

(*a*) **Networks:** Generator and Discriminator.

(*b*) **Generator:** Takes input noise (latent space) and produces fake data/images.

(*c*) **Discriminator:** Takes real/fake data as input and predicts authenticity (real or fake).

(*d*) **Applications:**

- Image synthesis (*e.g.*, AI paintings)
- Deepfake creation (*e.g.*, realistic video swaps) GANs enable creation of realistic media and data augmentation for ML training.

2. Sample Prompt for GAN Image

"A colorful image of a futuristic cityscape at night, with neon lights, flying cars and holographic signs, created in the style of science fiction illustration."

Chapter 8: Data Storytelling

Short Answer Type Questions

1. The three main elements of data storytelling are data, visuals and narrative. Data provides factual evidence and insights. Visuals, such as charts and graphs present complex data clearly. The narrative connects the data and visuals, explaining findings and making the story engaging and understandable for the audience.

2. Visuals help simplify complex data, making it easier to interpret and highlight key patterns or trends. They attract attention and make insights memorable. Two effective visual formats are bar charts, useful for comparing data across categories, and line graphs, ideal for showing trends over time.

3. Data storytelling combines analysis, visuals and narrative to make data meaningful and engaging, whereas presenting raw data merely lists information without context. Storytelling interprets, highlights insights and guides decision-making, making facts understandable and actionable for a wider audience.

4. A narrative in data storytelling is the structured storyline that ties together data and visuals. It provides context, explains patterns and relationships and emphasizes significance, helping the audience follow the flow of information and making insights relatable and persuasive.

5. Data storytelling can persuade stakeholders to invest in a project by illustrating positive trends with supporting visuals. It can also influence public health behaviors using clear narratives and charts about disease reduction due to vaccination or healthy practices.

6. Data analysis cleans and organizes raw data, uncovers trends and highlights key patterns. This groundwork ensures that only accurate, relevant and insightful information is used in the story, enhancing clarity, credibility and the impact of the final narrative.

7. The Resolution stage aims to resolve the main conflict or question raised in the story. It presents the solution, final outcome or key insight based on the data analysis, helping audiences understand what actions, changes, or decisions should follow from the findings.

Long Answer Type Questions

1. During a public health campaign about vaccination, presenting raw numbers may confuse the audience. However, using data storytelling—with clear visuals showing reduced disease cases over time and a narrative explaining community benefits—makes the impact of vaccinations compelling and convincing. This approach engages emotions, highlights trends and clarifies the benefits, making the evidence persuasive and understandable for non-experts and motivating them to participate in the campaign.

2. When presenting climate change data, I would consider audience knowledge, choose relatable visuals (like line graphs of temperature rise) and explain findings in simple language. The narrative would focus on local and global impacts; the urgency of the problem and actions individuals can take. Visual consistency, clarity and context are essential for ensuring understanding and inspiring action. I would also ensure data accuracy and address potential misconceptions.

3. A call to action is a concluding element that urges the audience to take specific steps or change behaviors based on the story's insights. It translates information into practical next steps, increasing the likelihood that the audience will use the new knowledge to make decisions, support initiatives, or adopt recommended changes, thus making data storytelling actionable and outcome-oriented.

4. Key criteria include clarity and accuracy of data, effectiveness of visuals in highlighting main points, the strength and coherence of the narrative, audience engagement and a well-defined call to action. The story should make complex information memorable, relatable and ensure the intended message or insight is clear and actionable.

5. Traditional data presentation often relies on static tables, reports, or lectures that may overwhelm or bore the audience. Data storytelling uses visuals and narrative, making insights accessible and memorable. While storytelling is engaging and persuasive, it requires more preparation and creativity. Traditional methods are direct but can be less effective in retaining audience attention or prompting action.

6. Freytag's Pyramid—comprising exposition, rising action, climax, falling action and resolution—provides a familiar narrative structure. Applying it to data storytelling helps guide the audience through background, conflict and solution, making insights more memorable and emotionally engaging, facilitating understanding and increasing the likelihood of meaningful response.

7. **Exposition:** Introduces the topic, context and baseline data (*e.g.*, air quality over five years).

    - **Inciting Incident:** Presents the problem, such as a report linking poor air quality to respiratory illness.
    - **Rising Action:** Shows data trends, *e.g.*, a sharp increase in AQI after industrial activity.
    - **Climax:** Main event, such as public protest or government intervention.
    - **Falling Action:** Displays the result of intervention, *e.g.*, AQI improvement.
    - **Resolution:** Summarizes findings and recommendations.
    - **Denouement:** Inspiring final message or focus on long-term impact.

    Each stage builds upon the last, leading from background through conflict to solution, ensuring clarity and engagement.

8. Freytag's Pyramid works well for stories with clear conflict and resolution but may not suit descriptive or cyclical data, ongoing trends or exploratory data analysis. In such cases, approaches like the "inverted pyramid" (key findings first), "comparison-focused" stories, or thematic grouping might be more effective, allowing for flexibility and emphasis on key insights without forcing a linear structure.

9. Simplifies complex data, making it understandable.

    - Engages and motivates the audience.
    - Aids in better decision-making by highlighting key insights.
    - Increases memorability and retention of information.

10. (*a*) Storytelling is universal and powerful because it connects with human emotions, transcends language barriers and employs familiar narrative structures, making information relatable and easily remembered. It is present across cultures and generations, helping to pass down knowledge and values in an accessible and engaging way.

(*b*) Image 2 is better because it is clearer, visually organized and provides the information about the source.

11. (*a*) Collect and organize relevant data.

- Clean and preprocess for accuracy.
- Use appropriate visualizations to explore patterns.
- Build a narrative that contextualizes insights.
- Highlight key findings with clear recommendations or calls to action.

(*b*) **Option B is better:** It provides specifics (exact area increase by state), uses color coding, and contextualizes the importance of the change, making interpretation easier and the story more convincing than merely listing state names.

12. The purpose of data storytelling is to convert complex data into meaningful insights, motivating informed decisions.

- **Data** provides the factual foundation.
- **Narrative** guides the audience through context and reasoning, making findings relatable.
- **Visuals** clarify trends, patterns, and differences, reinforcing understanding. This integration ensures data is engaging, understandable and actionable.

13. To find compelling stories in datasets like the attached graph, follow these steps: First, explore and clean the data to ensure accuracy. Analyze the data to identify trends, changes, and outliers—in this case, noting shifts in hydro, windmill and solar power generation over the years. Visualize key comparisons and highlight meaningful patterns using clear charts. Next, construct a narrative that explains the significance behind these trends, connecting them to real-world implications or decisions. Finally, conclude with actionable insights or recommendations, ensuring your story is relevant, concise and easily understood by the target audience.

Case-based/HOTS Questions

Case 1. Green Revolution:

(*a*) (*iii*) **Simple infographics with clear icons and minimal text:** These are easier to understand for a diverse audience, especially those with limited reading skills.

(*b*) (*iii*) **Showcasing environmental benefits and long-term sustainability:** Focusing on real-world positive outcomes makes the narrative relevant and persuasive.

Case 2. E-commerce Engagement:

(*a*) (*ii*) **By presenting a time series chart comparing clicks and abandonments:** This visualization lets the retailer track changes and spot periods where engagement drops.

(*b*) (*iii*) **Analyze user behavior patterns to suggest website design improvements:** Tailored solutions based on data-driven insights are more effective than generic actions.

Case 3.

(*a*) (*iii*) Personal stories and testimonials from people who improved their health through exercise

(*b*) (*ii*) By showcasing before-and-after photos of people who lost weight

(*iii*) By highlighting the potential risks of not exercising

(*iv*) By creating an interactive tool that personalizes exercise plans

Image-based Questions

1. **Chart Types in Storytelling**
   - **Bar Chart (A):** Best for comparing values across categories (*e.g.*, employee performance).
   - **Scatter Plot (B):** Reveals correlation/patterns between two variables (*e.g.*, body mass vs. flipper length).
   - **Line Graph (C):** Visualizes trends over time (*e.g.*, monthly sales).
2. **Freytag's Pyramid – Matching Steps:**
   1. Exposition – (a) Present air quality index data over the last 5 years.
   2. Inciting Incident – (b) Introduce a new study linking poor air quality to increased respiratory illness.
   3. Rising Action – (c) Show a sharp increase in AQI after industrial expansion.
   4. Climax – (d) Residents protest and the government intervenes with new policies.
   5. Falling Action – (e) Data shows AQI improving after intervention.
   6. Resolution – (f) Experts summarize long-term benefits and next steps.
   7. Denouement – (g) Conclude with an inspiring message on civic engagement and data-driven decisions.