केन्द्रीय विद्यालय संगठन

Kendriya Vidyalaya Sangathan

कृत्रिम बुद्धिमता

ARTIFICIAL INTELLIGENCE

कक्षा/Class: X

2024-25

विद्यार्थी अध्ययन सामग्री

Student Support Material

संदेश

विद्यालयी शिक्षा में शैक्षिक उत्कृष्टता प्राप्त करना केन्द्रीय विद्यालय संगठन की सर्वोच्च वरीयता है। हमारे विद्यार्थी, शिक्षक एवं शैक्षिक नेतृत्व कर्ता निरंतर उन्नति हेतु प्रयासरत रहते हैं। राष्ट्रीय शिक्षा नीति 2020 के संदर्भ में योग्यता आधारित अधिगम एवं मूल्यांकन संबन्धित उद्देश्यों को प्राप्त करना तथा सीबीएसई के दिशा निर्देशों का पालन, वर्तमान में इस प्रयास को और भी चुनौतीपूर्ण बनाता है।

केन्द्रीय विद्यालय संगठन के पांचों **आंचलिक शिक्षा एवं प्रशिक्षण संस्थान** द्वारा संकलित यह 'विद्यार्थी सहायक सामग्री' इसी दिशा में एक आवश्यक कदम है । यह सहायक सामग्री कक्षा 9 से 12 के विद्यार्थियों के लिए सभी महत्वपूर्ण विषयों पर तैयार की गयी है । केन्द्रीय विद्यालय संगठन की 'विद्यार्थी सहायक सामग्री' अपनी गुणवत्ता एवं परीक्षा संबंधी सामग्री-संकलन की विशेषज्ञता के लिए जानी जाती है और अन्य शिक्षण संस्थान भी इसका उपयोग परीक्षा संबंधी पठन सामग्री की तरह करते रहे हैं । शुभ-आशा एवं विश्वास है कि यह सहायक सामग्री विद्यार्थियों की सहयोगी बनकर सतत मार्गदर्शन करते हुए उन्हें सफलता के लक्ष्य तक पहुंचाएगी ।

शुभाकांक्षा सहित ।

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SYLLABUS

CBSE | DEPARTMENT OF SKILL EDUCATIONCURRICULUM FOR SESSION 2024-2025

ARTIFICIAL INTELLIGENCE (SUB. CODE 417)

CLASS – X

OBJECTIVES OF THE COURSE:

The objective of this module/curriculum - which combines both Inspire and Acquire modules is to develop a readiness for understanding and appreciating Artificial Intelligence and its application in our lives. This module/curriculum focuses on:

1. Helping learners understand the world of Artificial Intelligence and its applications through games, activities and multi-sensorial learning to become AI-Ready.
2. Introducing the learners to three domains of AI in an age-appropriate manner.
3. Allowing the learners to construct meaning of AI through interactive participation and engaginghands-on activities.
4. Introducing the learners to AI Project Cycle.
5. Introducing the learners to programming skills - Basic python coding language.

LEARNING OUTCOMES:

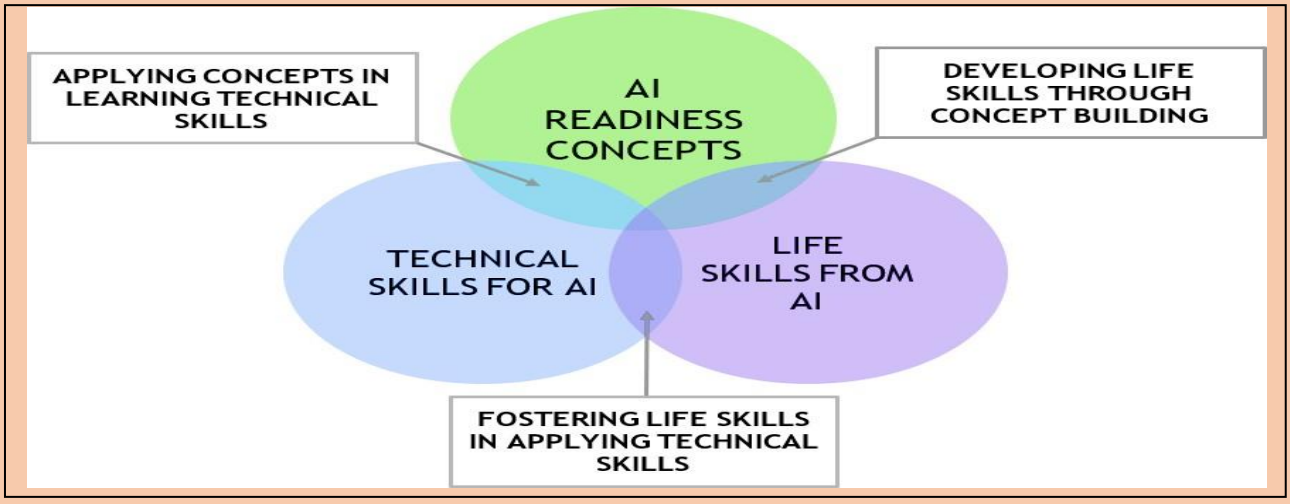
Learners will be able to

1. Identify and appreciate Artificial Intelligence and describe its applications in daily life.
2. Relate, apply and reflect on the Human-Machine Interactions to identify and interact with the three domains of AI: Data, Computer Vision and Natural Language Processing and Undergo assessment for analysing their progress towards acquired AI-Readiness skills.
3. Imagine, examine and reflect on the skills required for futuristic job opportunities.
4. Unleash their imagination towards smart homes and build an interactive story around it.
5. Understand the impact of Artificial Intelligence on Sustainable Development Goals to develop

responsible citizenship.

6. Research and develop awareness of skills required for jobs of the future.
7. Gain awareness about AI bias and AI access and describe the potential ethical considerationsof AI.
8. Develop effective communication and collaborative work skills.
9. Get familiar and motivated towards Artificial Intelligence and Identify the AI Project Cycle framework.
10. Learn problem scoping and ways to set goals for an AI project and understand the iterativenature of problem scoping in the AI project cycle.
11. Brainstorm on the ethical issues involved around the problem selected.
12. Foresee the kind of data required and the kind of analysis to be done, identify data requirementsand find reliable sources to obtain relevant data.
13. Use various types of graphs to visualize acquired data.
14. Understand, create and implement the concept of Decision Trees.
15. Understand and visualize computer's ability to identify alphabets and handwritings.
16. Understand and appreciate the concept of Neural Network through gamification and learn basic programming skills through gamified platforms.
17. Acquire introductory Python programming skills in a very user-friendly format.

SKILLS TO BE DEVELOPED:



SCHEME OF STUDIES:

This course is a planned sequence of instructions consisting of units meant for developing employability and vocational competencies of students of Class IX opting for skill subject along with other educationsubjects.

The unit-wise distribution of hours and marks for class IX & X is as follows:

ARTIFICIAL INTELLIGENCE (SUBJECT CODE 417)
CLASS – X (SESSION 2024-2025)

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

	UNITS	NO. OF HOURS for Theory and Practical		MAX. MARKS for Theory and Practical
PART A	**Employability Skills**			
	Unit 1: Communication Skills-II	10		2
	Unit 2: Self-Management Skills-II	10		2
	Unit 3: ICT Skills-II	10		2
	Unit 4: Entrepreneurial Skills-II	15		2
	Unit 5: Green Skills-II	05		2
	Total	**50**		**10**
PART B	**Subject Specific Skills**	**Theory**	**Practical**	
	Unit 1: Introduction to Artificial Intelligence (AI)	15	-	7
	Unit 2: AI Project Cycle	15	-	9
	Unit 3: Advance Python *(To be assessed in Practicals only)*	-	30	--
	Unit 4: Data Science (Introduction, Applications ofData Sciences, Data Science: Getting Started (up to Data Access), *remaining portion is to be assessed in practical*	7	8	4
	Unit 5: Computer Vision (Introduction, Applications of Computer Vision, Computer Vision:Getting Started (up to RGB Images), *remaining portion is to be assessed in practical*	12	18	4
	Unit 6: Natural Language Processing	25	5	8
	Unit 7: Evaluation	15		8
	Total	**150**		**40**
PART C	**Practical Work:**			
	Practical File with minimum 15 Programs			15
	Practical Examination • Unit 3: Advance Python • Unit 4: Data Science • Unit 5: Computer Vision			5 5 5
	Viva Voce			5
	Total			**35**
PART D	Project Work / Field Visit / Student Portfolio (Any one to be done)			10
	Viva Voce			5
	Total			**15**
	GRAND TOTAL	**210**		**100**

DETAILED CURRICULUM/TOPICS FOR CLASS X

Part-A: EMPLOYABILITY SKILLS

S. No.	Units	Duration in Hours
1.	Unit 1: Communication Skills-II	10
2.	Unit 2: Self-management Skills-II	10
3.	Unit 3: Information and Communication Technology Skills-II	10
4.	Unit 4: Entrepreneurial Skills-II	15
5.	Unit 5: Green Skills-II	05
	TOTAL	**50**

Note: The detailed curriculum/ topics to be covered under Part A: Employability Skills can be downloaded from CBSE website

Part-B – SUBJECT SPECIFIC SKILLS

- Unit 1: Introduction to Artificial Intelligence (AI)
- Unit 2: AI Project Cycle
- Unit 3: Advance Python
- Unit 4: Data Science
- Unit 5: Computer Vision
- Unit 6: Natural Language Processing
- Unit 7: Evaluation

UNIT 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
Foundational concepts of AI	Understand the concept of human intelligence and its various components such as reasoning, problem-solving, and creativity	**Session**: What is Intelligence?
		Session: Decision Making. ● How do you make decisions? ● Make your choices!
		Session: what is Artificial Intelligence and whatis not?
Basics of AI:Let's Get Started	Understand the concept ofArtificial Intelligence (AI) and its domains	**Session**: Introduction to AI and related terminologies. ● Introducing AI, ML & DL. ● Introduction to AI Domains (Data Sciences,CV & NLP) ● Gamified tools for each domain- ○ Data Sciences- Impact Filter (Impact ofrise in temperature on different species) https://artsexperiments.withgoogle.com /impactfilter/ ○ CV- Autodraw (It pairs machine learning with drawings from talentedartists to help you draw stuff fast.) https://www.autodraw.com/

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
		○ NLP- Wordtune (AI writing tool that rewrites, rephrases, and rewords your writing) https://www.wordtune.com/
	Explore the use of AI in real Life.	**Session:** Applications of AI – A look at Real-lifeAI implementations
	Learn about the ethical concerns involved in AI development, such as AI bias,data privacy and how they canbe addressed.	**Session:** AI Ethics ● Moral Machine Activity : a platform for gathering a human perspective on moral decisions made by machine intelligence, such as self-driving cars. http://moralmachine.mit.edu/

UNIT 2: AI PROJECT CYCLE

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
Introduction	Understand the stages involved in the AI project cycle, such as problem scoping, data collection, data exploration, modeling, evaluation.	**Session:** Introduction to AI Project Cycle
Problem Scoping	Learn about the importance of project planning in AI development and how to define project goals and objectives.	**Session:** Understanding Problem Scoping & Sustainable Development Goals
Data Acquisition	Develop an understanding of the importance of data collection in AI and how to choose the right data sources.	**Session:** Simplifying Data Acquisition
Data Exploration	Know various data exploration techniques and its importance	**Session:** Visualising Data
Modelling	Know about the different machine learning algorithms used to train AI models	**Session:** Introduction to modelling • Introduction to Rule Based & Learning Based AI Approaches • Activity : Teachable machineto demonstrate Supervised Learning https://teachablemachine.withgoogle.com/ • Activity : Infinite Drum Machine to demonstrate Unsupervised learning https://experiments.withgoogle.com/ai/drum-machine/view/ • Introduction to Supervised, Unsupervised & *Reinforcement Learning Models* ***(Optional)***** • Neural Networks
Evaluation	Know the importance of evaluation and various metrics available for evaluation	**Session:** Evaluating the idea!

UNIT 3 : ADVANCE PYTHON (To be assessed through Practicals)

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
Recap	Understand to work with Jupyter Notebook, creating virtual environment, installing Python Packages.	**Session:** Jupyter Notebook
	Able to write basic Python programs using fundamental concepts such as variables, data types, operators, and control structures.	**Session:** Introduction to Python
	Able to use Python built-in functions and libraries.	**Session:** Python Basics

UNIT 4: DATA SCIENCES (To be assessed through Theory)

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
Introduction	Define the concept of Data Science and understand its applications in various fields.	**Session:** Introduction to Data Science
		Session: Applications of Data Science
Getting Started	Understand the basic concepts of data acquisition, visualization, and exploration.	**Session:** Revisiting AI Project Cycle, Data Collection, Data Access Activities: Game: Rock, Paper & Scissors https://next.rockpaperscissors.ai/

UNIT 4: DATA SCIENCES (To be assessed through Practicals)

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
Python Packages	Use Python libraries such as NumPy, Pandas, and Matplotlib for data analysis and visualization.	**Session**: Python for Data Sciences • Numpy • Pandas • Matplotlib
Concepts of Data Sciences	Understand the basic concepts of statistics, such asmean, median, mode, and standard deviation, and applythem to analyze data using various Python packages.	**Session:** Statistical Learning & Data Visualisation
K-nearest neighbour model ***(Optional)*****	*Understand the basic concepts of the KNN algorithm and its applications in supervised learning.*	***Activity:*** *Personality Prediction* ***(Optional)***** ***Session:*** *Understanding K-nearest neighbourmodel* ***(Optional)*****

UNIT 5: COMPUTER VISION (To be assessed through Theory)

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
Introduction	Define the concept of Computer Vision and understand its applications in various fields.	**Session:** Introduction to Computer Vision
		Session: Applications of CV
Concepts of Computer Vision	Understand the basic concepts of image representation, feature extraction, object detection, and segmentation.	**Session:** Understanding CV Concepts ● Computer Vision Tasks ● Basics of Images-Pixel, Resolution, Pixel value ● Grayscale and RGB images
		Activities: ● Game- Emoji Scavenger Hunt https://emojiscavengerhunt.withgoogle.com/ ● RGB Calculator: https://www.w3schools.com/colors/colors_rgb.asp ● Create your own pixel art: www.piskelapp.com ● Create your own convolutions: http://setosa.io/ev/image-kernels/

UNIT 5: COMPUTER VISION (To be assessed through Practicals)

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
OpenCV	Use Python libraries such as OpenCV for basic image processing and computer vision tasks.	**Session:** Introduction to OpenCV
		Hands-on: Image Processing
Convolution Operator ***(Optional)*****	*Apply the convolution operator to process images and extract useful features.*	***Session:** Understanding Convolution operator **(Optional)***
		Activity:** Convolution Operator **(Optional)*
Convolution Neural Network ***(Optional)*****	*Understand the basic architecture of a CNN and its applications in computer vision and image recognition.*	***Session:** Introduction to CNN **(Optional)****
		Session:** Understanding CNN **(Optional)* ● *Kernel* ● *Layers of CNN*
		Activity:** Testing CNN **(Optional)*

UNIT 6: NATURAL LANGUAGE PROCESSING

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
Introduction	Understand the concept of Natural Language Processing (NLP) and its importance in the field of Artificial Intelligence (AI).	**Session:** Introduction to Natural Language Processing Activity : Use of Google Translate for same spelling words
		Session: NLP Applications
		Session: Revisiting AI Project Cycle
Chatbots	Explore the various applications of NLP in everyday life, such as chatbots,sentiment analysis, and automatic summarization	**Activity:** Introduction to Chatbots
Language Differences	Gain an understanding of the challenges involved in understanding human language by machine.	**Session:** Human Language VS Computer Language
Concepts of Natural Language Processing	Learn about the Text Normalization technique used in NLP and popular NLP model - Bag-of-Words	**Session: Data Processing** • Text Normalisation • Bag of Words **Hands-on:** Text processing ● Data Processing ● Bag of Words ● *TFIDF (Optional)*** ● *NLTK (Optional)***

UNIT 7: EVALUATION

SUB-UNIT	LEARNING OUTCOMES	SESSION/ ACTIVITY/ PRACTICAL
Introduction	Understand the role of evaluation in the development and implementation of AI systems.	**Session:** Introduction to Model Evaluation ● What is Evaluation? ● Different types of Evaluation techniques- Underfit, Perfect Fit, OverFit
Model Evaluation Terminology	Learn various Model Evaluation Terminologies	**Session:** Model Evaluation Terminologies ● The Scenario - Prediction, Reality, True Positive, True Negative, False Positive, False Negative ● Confusion Matrix ● Activity- to make a confusion matrix based on data given for Containment Zone Prediction Model
Confusion Matrix	Learn to make a confusion matrix for given Scenario	**Session & Activity:** Confusion Matrix
Evaluation Methods	Learn about the different typesof evaluation techniques in AI,such as Accuracy, Precision, Recall and F1 Score, and theirsignificance.	**Session:** Evaluation Methods ● Accuracy ● Precision ● Recall ● Which Metric is Important? - Precision or Recall ● F1 Score
		Activity: Practice Evaluation

PART-C: PRACTICAL WORK

Suggested Programs List	• Write a program to add the elements of the two lists. • Write a program to calculate mean, median and mode using Numpy • Write a program to display line chart from (2,5) to (9,10). • Write a program to display a scatter chart for the following points (2,5), (9,10),(8,3),(5,7),(6,18). • Read csv file saved in your system and display 10 rows. • Read csv file saved in your system and display its information • Write a program to read an image and display using Python • Write a program to read an image and identify its shape using Python
Important Links	• https://cbseacademic.nic.in/web_material/Curriculum21/publication/secondary/Class10_Facilitator_Handbook.pdf • Link to AI Activities & Jupyter Notebooks (including sample projects) https://bit.ly/class_X_activities_jupyter_notebooks

PART-D: Project Work / Field Visit / Student Portfolio

*** relate it to Sustainable Development Goals**

Suggested Projects/ Field Visit / Portfolio (any one activity to be one)

Sample Projects	1. Student Marks Prediction Model 2. CNN Model on Smoke and Fire Detection
Field Work	Students' participation in the following- • AI for Youth Bootcamp • AI Fests/ Exhibition • Participation in any AI training sessions • Virtual tours of companies using AI to get acquainted with real-life usage
Student Portfolio (to be continued from class IX)	• Maintaining a record of all AI activities • Hackathons • Competitions (CBSE/Interschool) Note: Portfolio should contain minimum 5 activities

*****NOTE: Optional components shall not be assessed. They are for extra knowledge***

LIST OF ITEMS/ EQUIPMENTS (MINIMUM REQUIREMENTS):

The equipment / materials listed below are required to conduct effective hands-on learning sessions while delivering the AI curriculum to class 10 students. The list below consists of minimal configurationrequired to execute the AI curriculum for class 10 and create social impact real time solutions/ projects.The quantities mentioned here are recommended for a batch of 20 students keeping the human- machine ratio as 2:1. An exhaustive list may be compiled by the teacher(s) teaching the subject.

S. NO.	ITEM NAME, DESCRIPTION & SPECIFICATION
A	**SYSTEM SPECIFICATIONS**
1	Processor: Intel® Core™ i5-7300U Processor or equivalent with minimum SYSmark®2018 Rating of 750 or higher
2	Graphic Card: Integrated graphics
3	Form Factor: - USFF (Ultra Small Form factor) System chassis volume less than One Litre
4	RAM: 8GB DDR4 – 2400MHz or above
5	Storage: 500 GB HDD – 7200 rpm
6	Display: 18.5” LED Monitor with HDMI, in-built-speaker,
7	Keyboard: Keyboard with numerical keypad (recommended)
8	Mouse: Optical Mouse
9	Webcam: Full HD Camera
10	Headphones with Mic
11	Dual Band Wireless Connectivity Min 800 Mbps
12	Bluetooth V4.2 or Higher
13	Ports: 4 USB 3.0 ports, dual high-definition display ports (HDMI 2.0/DP/thunderbolt 3.0ports), High definition 8-channel audio through HDMI interface or through audio jack.
14	VPU: - Integrated or support for VPU - vision processing unit to accelerate AI machinevision applications.
B	**SOFTWARE SPECIFICATIONS**
1	Operating System: Any
2	Anti-Virus Activated
3	Internet Browser: Google Chrome
4	Productivity Suite: Any (Google+ Suite recommended)
5	Anaconda Navigator Distribution (https://bit.ly/AI-installation-guide)
6	Conceptual installations (https://bit.ly/AI-installation-guide)
7	Intel Open VINO tools
8	Python

NOTE: In keeping with the spirit of Recycle, Upcycle and Reuse, it is recommended to make use ofany equipment/ devices/ accessories from the existing inventory in school.

PART-A: EMPLOYABILITY SKILLS

UNIT-1: COMMUNICATION

Communication is the act of giving, receiving, and sharing information -- in other words, talking or writing, and listening or reading. Good communicators listen carefully, speak or write clearly, and respect different opinions.

Communication is defined as the imparting or exchanging of information by speaking, writing, or using some other medium

Communication skills allow you to understand and be understood by others.

These can include but are not limited to effectively communicating ideas to others, actively listening in conversations, giving, and receiving critical feedback and public speaking.

Communication skills involve listening, speaking, observing, and empathizing. It is also helpful to understand the differences in how to communicate through face to-face interactions, phone conversations, and digital communications like email and social media.

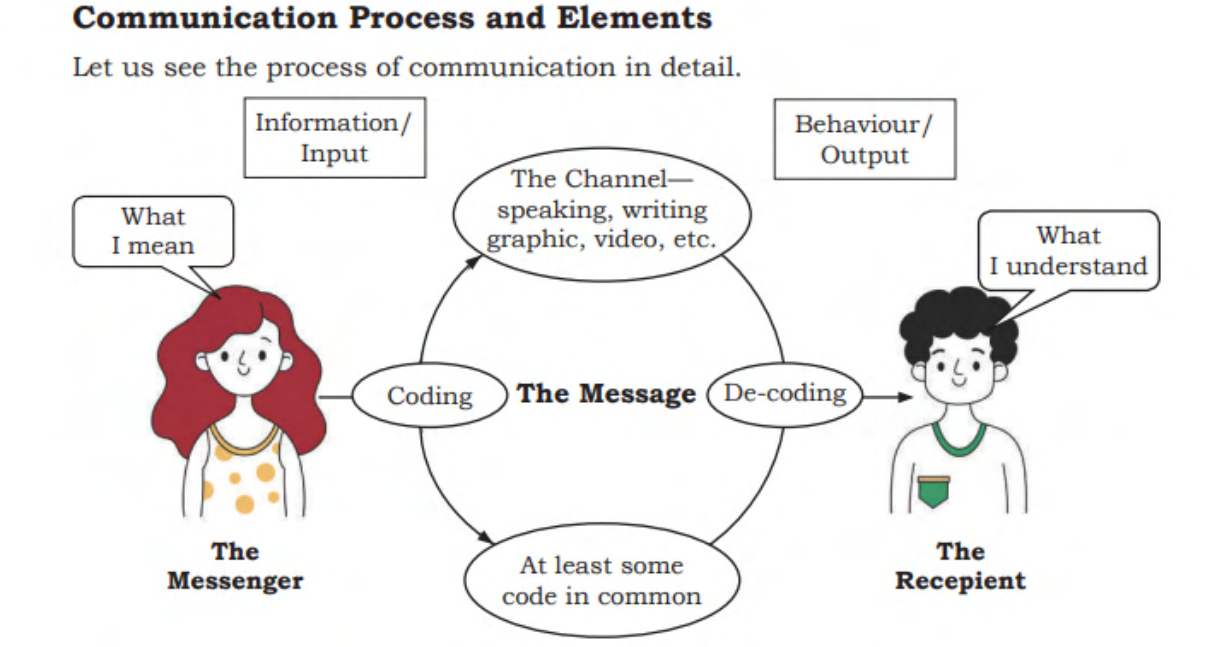
Session 1 – Methods of Communication:

The word 'communication' comes from the Latin word: commūnicāre, meaning'to share'.

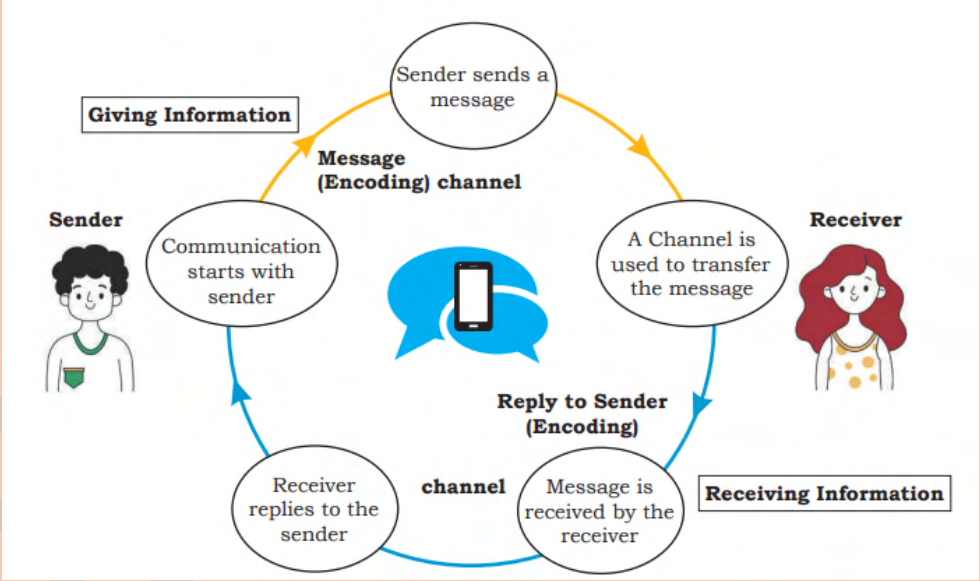
Communication Skills

Communication has three important parts:

1. Transmitting — The sender transmits the message through one medium or another.
2. Listening — The receiver listens or understands the message.
3. Feedback — The receiver conveys their understanding of the message tothe sender in the form of feedback to complete the communication cycle.



Elements of Communication



The various elements of a communication cycle are:

Sender: the person beginning the communication.

Message: the information that the sender wants to convey.

Channel: the means by which the information is sent.

Receiver: the person to whom the message is sent.

Feedback: the receiver's acknowledgement and response to the message.

Types of Communication

Face-to-face informal communication: There is nothing better than face-to-face communication. It helps the message to be understood clearly and quickly. Also, since body language can be seen in this case; it adds to the effectiveness of the communication.

e-mail: e-mail can be used to communicate quickly with one or many individuals in various locations. It offers flexibility, convenience and low-cost.

Notices/Posters: It is effective when the same message has to go out to a large group of people. Generally used for where email communication may not be effective.

For example, 'Change in the lunch time for factory worker,' or 'XYZ Clothing will remain closed for customers on Sunday.'

Business Meetings: Communication during business meetings at an organisation are generally addressed to a group of people. It can be related to business, management and organisational decisions.

Other Methods There can be various other methods like social networks, message, phone call for communication, newsletter, blog, etc.

Verbal Communication

Verbal communication includes sounds, words, language, and speech.

Type of Verbal Communication

Interpersonal Communication:

This form of communication takes place between two individuals and is thus, a one-on-one conversation. It can be formal or informal.

Examples

1. A manager discussing the performance with an employee.
2. Two friends discussing homework.
3. Two people talking to each other over phone or video call.

Written Communication: This form of communication involves writing words. It can be letters, circulars, reports, manuals, SMS, social media chats, etc. It can be between two or more people.

Examples

1. A manager writing an appreciation e-mail to an employee.

2. Writing a letter to grandmother enquiring about health.

Small Group Communication:

This type of communication takes place when there are more than two

people involved. Each participant can interact and converse with the rest.

Examples

1. Press conferences

2. Board meetings

3. Team meetings

Advantages of Verbal Communication:

- It is an easy mode of communication in which you can exchange ideas by saying what you want and get a quick response.
- It enables you to keep changing your interaction as per the other person's response.

Disadvantages of Verbal Communication:

- Since verbal communication depends on written or spoken words, sometimes the meanings can be confusing and difficult to understand if the right words are not used.

Non-Verbal Communication:

Non-verbal communication is the expression or exchange of information or messages

without using any spoken or written word. In other words, we send signals and messages to others, through expressions, gestures, postures, touch, space, eye contact and para language.

Importance of Non-verbal Communication

In our day-to-day communication

• 55% communication is done using body movements, face, arms, etc.

• 38% communication is done using voice, tone, pauses, etc.

• only 7% communication is done using words. Around 93% of our communication is non-verbal.

Type of Non-Verbal Communication

Gestures

• Raising a hand to greet or say goodbye

• Pointing your finger at someone

Expressions

• Smiling when you are happy

• Making a sad face when you are sad

Body Language

Postures by which attitudes and feelings are communicated. Standing straight, showing interest

Visual Communication

Visual communication proves to be effective since it involves interchanging messages only through images or pictures and therefore, you do not need to know any particular language for understanding it. It is simple and remains consistent across different places.

Some examples:

No parking zone		No entry	
Danger warning		Radiation/biohazard warning	
Under CCTV surveillance		No mobile phone	

Communication Cycle and Importance of Feedback:

Feedback is an important part of the communication cycle. For effective communication, it is important that the sender receives an acknowledgement from the receiver about getting the message across.

Feedback can be positive or negative. A good feedback is always

- Specific
- Helpful
- kind
- Timely
- Offering continuous support

Importance of Feedback
Feedback is the final component and one of the most important factors in the process of communication since it is defined as the response given by the receiver to the sender. Let us look at certain reasons why feedback is important.

• It validates effective listening
• It motivates
• It is always there
• It boosts learning
• It improves performance

Barriers to Effective Communication

EFFECTIVE COMMUNICATION

Introduction: Effective communication is a two-way communication process where both parties have right and convenience to express their messages opinions, facts and other information

7Cs of Effective Communication

- Clear: While communicating one should be clear about what he / she say.
- Concise: Use simple words and say only what is needed.

- Concrete: Your arguments should be based on solid facts and opinions from credible sources and you should share reliable data to support your stand.
- Correct: It's essential that along with the factual information, the language and grammar you use are correct.
- Coherent: Your words should make sense. Along with that it should related with the main topic
- Complete: Your message should be complete. It should have all the needed information
- Courteous: Be respectful, honest and friendly throughout your communication

Barriers in communication

- Linguistic Barrier: Language at times can be a barrier to effective communication
- Physical Barrier: If the surroundings do not support proper communication, it can also act as a barrier to appropriate interaction.
- Cultural Barrier: Cultural differences hinder us from communicating properly.
- Interpersonal Barriers: It refers to the situations when the intended message is received incorrectly due to many personal reasons.
- Organizational Barriers: In an organization if there is no clarity about the roles, structures, responsibilities, it will hinder effective communication among the members of the organization

Ways to Overcome Barriers to Effective Communication

• Use simple language
• Do not form assumptions on culture, religion or geography
• Try to communicate in person as much as possible
• Use visuals
• Take help of a translator to overcome differences in language
• Be respectful of other's opinions

Writing Skills — Parts of Speech

Capitalisation Rules

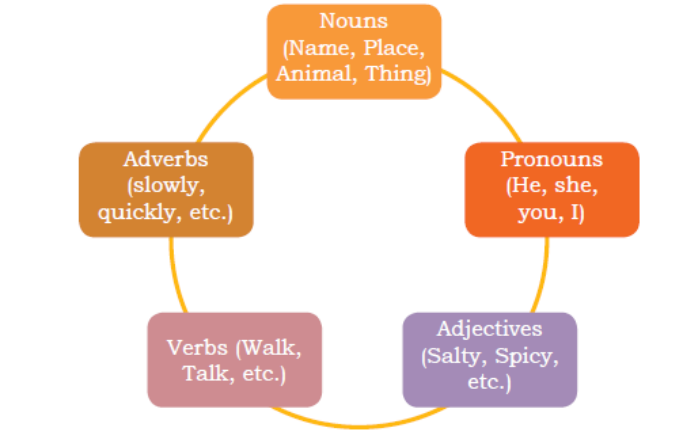
Alphabet	T	I	N	S
What it shows:	Titles	word 'I'	Names	Starting letter of sentences
Rule	Capitalise the first letter in the titles used before people's names.	Capitalise the letter 'I' when it is used as a word (Pronoun).	Capitalise the first letter in the names of people, places, days and months.	Capitalise the first letter in every sentence.
Example	Dr Malik and Mr Pandey were invited to the party.	He said that I should accompany him to the mall.	The summer break is starting this Friday and will continue till the end of June. Suresh is planning to visit London next year.	The little girl lost her book.

Punctuation

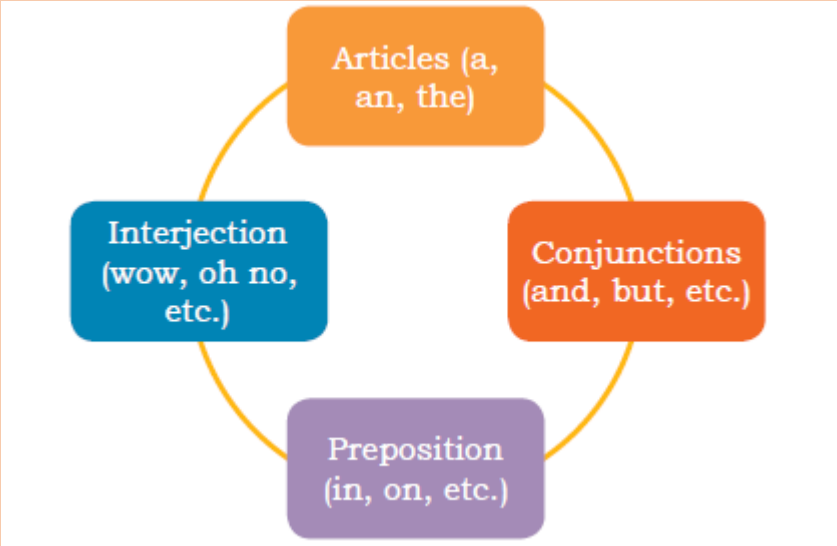
Punctuation name	Sign	Use	Example
Full stop	.	• Used at the end of a sentence. • Used with short form of long words.	Omar is a professor. His students call him Prof. Omar.
Comma	,	• Used to indicate a pause in the sentence. • Used to separate two or more items in a row.	After getting down from the bus, I walked towards my school. The grocery store had fresh kiwis,strawberries and mangoes.
Question mark	?	• Used at the end of a question.	Where is your book?
Exclamation mark	!	• Used at the end of a word or a sentence to indicate a strong feeling.	What a beautiful dress! Hooray! We won the match.
Apostrophe	(')	• Used followed by an 's' to show possession or belonging. • Used with shortened form of words in informal speech.	That is Shobha's cat. Are these Rahim's colour pencils? Let's go for the movies today. She isn't coming to school today.

Basic Parts of Speech

The part of speech indicates how a particular word functions in meaning as well as grammatically within the sentence.



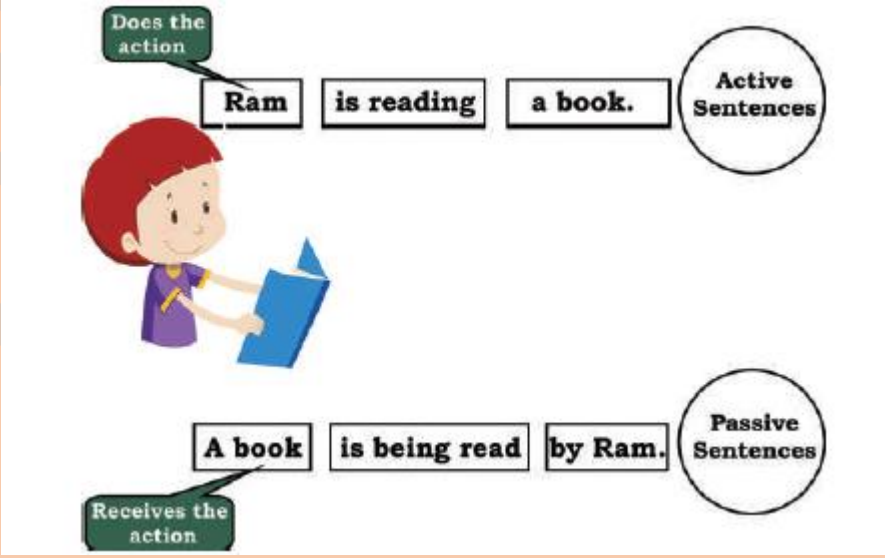
Supporting Parts of Speech Types



Writing Skills — Sentences
Parts of a Sentence

Subject: Person or thing that performs an action.
Verb: Describes the action.
Object: Person or thing that receives the action.

Active and Passive Sentences



	ONE MARK QUESTIONS	
1	Which of the following is not a form of written communication? a) Circulars b) Reports c) Discussion d) SMS	1
2	Which of these is NOT a common communication barrier? a) Linguistic barrier b) Interpersonal barrier c) Financial barrier d) Organizational barrier	1
3	Ramya travelled to Sweden from India to pursue her higher education. But she doesn't know how to speak Swedish (language of Sweden). Because of this, she was unable to find a part time job. This is an example of _____ .(CBSE 23-24) (a) Interpersonal barrier (b) Physical barrier (c) Organisational barrier (d) Linguistic barrier	1
4	Rohit, when leaving from his friend's house is bidding goodbye by waving his hands. Which type of non-verbal communication is used by Rohit? a) Expression b) Body language c)Gesture d)All the above	1
5	Identify the object, verb and subject in the sentence, 'The car crashed into a tree.' a) Object: a tree; Verb: crashed; Subject: the car b) Object: The car; Verb: crashed; Subject: a tree c) Object: crashed; Verb: the tree; Subject: the car d) Object: crashed; Verb: the car; Subject: the tree	1
6	The _____ conveys the message to the sender in the form of feedback for the completion of communication cycle. (a) Sender (b) Receiver (c) Channel (d) Protocol	1
7	Identify the sentence type - "I drove to the office, and then I walked to the cabin." (a) Simple (b) Compound (c) Complex (d) Both compound and complex	1
8	Which of the following is NOT an element of communication within the communication process cycle?	1

	(a) Channel (b) Receiver (c) Sender (d) Time	
9	How much % of the communication that we do in our day-to-day communication is non-verbal? a) 55% b) 93% c) 7% d) 38%	1
10	You need to apply leave at work? Which method of communication will you use? (a) e-mail (b) Poster (c) Newsletter (d) Blog	1
11	Which of the following is an example of oral communication? (a) Newspapers (b) Letters (c) Phone call (d) e-mail	1
12	Which of the following statement is true about communication? (a) 50% of our communication is non-verbal (b) 20% communication is done using body movements, face, arms, etc. (c) 5% communication is done using voice, tone, pauses, etc. (d) 7% communication is done using words	1
13	Which of these are examples of positive feedback? (a) Excellent, your work has improved. (b) I noticed your dedication towards the project. (c) You are always doing it the wrong way. (d) All of the above	1
14	Which of these sentences is capitalised correctly? (a) Ravi and I are going to the movies. (b) Salim is visiting India in July. (c) The Tiger is a strong animal. (d) She is arriving on Monday.	1
15	_____communication is the use of body language, gestures and facial expressions to convey information to others. (CBSE 2020-21)	1

ANSWERS

1. c) Discussion	2. (c) Financial barrier	3. (d) Linguistic barrier	4. c) Gesture	5. a) Object: a tree; Verb: crashed; Subject: the car
6. c) channel	7. b) Compound	8. d) Time	9. b) 93%	10. (a) e-mail
11. (c) Phone call	12. (d) 7% communication is done using words	13. (a) Excellent, your work has improved	14. (d) She is arriving on Monday.	15.Non-verbal Communication

	TWO MARK QUESTIONS WITH ANSWERS	
1	List different methods of communication. Ans: Different methods of communication are: face to face talk, e-mail, letters, notice board. Posters, meetings, phone call, video call, virtual meeting, writing blog etc	2
2	Enumerate any two ways to overcome barriers to effective communication. Ways to Overcome Barriers to Effective Communication (Any Two) a) Use simple language b) Do not form assumptions on culture, religion or geography c) Try to communicate in person as much as possible d) Use visuals e) Take help of a translator to overcome differences in language f) Be respectful of other's opinions	2
3	List two best practices for effective communication. (CBSE 2023-24) Ans: There are different methods of communication: non-verbal, verbal and visual. However, all these methods can only be effective if we follow the basic principles of professional communication skills. These can be abbreviated as 7 Cs i.e., Clear, Concise, Concrete, Correct, Coherent, Complete and Courteous. (Any two of 7 C's)	2
4	 The symbol shown represents "No Parking zone". What type of communication uses such symbols and what is the advantage of using that form of communication?	2

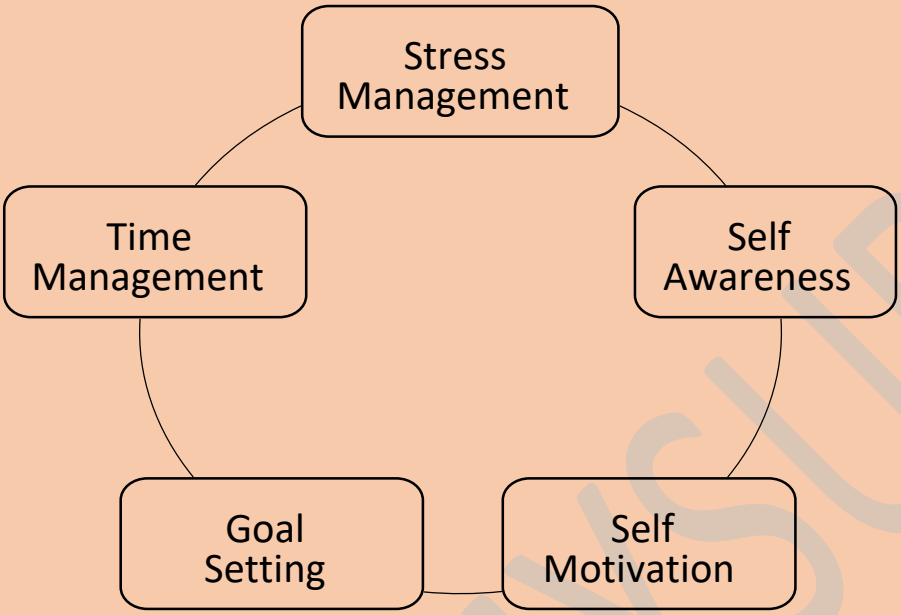
	Ans: a) Visual Communication b) Visual communication proves to be effective since it involves interchanging messages only through images or pictures and therefore, you do not need to know any particular language for understanding it. It is simple and remains consistent across different places.	
5	Explain the following terms: a) Group Communication b) Interpersonal Communication Ans: **Group communication**: This type of communication takes place when there are more than two people involved. Each participant can interact and converse with the rest. Examples 1. Press conferences 2. Board meetings 3. Team meetings **Interpersonal Communication**: This form of communication takes place between two individuals and is thus a one-on-one conversation. It can be formal or informal. Examples 1. A manager discussing the performance with an employee. 2. Two friends discussing homework. 3. Two people talking to each other over phone or video call.	2
6	List the different types of verbal communication? Ans: a) Interpersonal Communication b) Written Communication c)Group Communication d)Public Communication	2
7	Feedback is the final component and one of the most important factors in the process of communication. Give two reasons to justify why feedback is important. Ans: It validates effective listening: The person providing the feedback knows they have been understood (or received) and that their feedback provides some value. • It motivates: Feedback can motivate people to build better work relationships and continue the good work that is being appreciated. • It is always there: Every time you speak to a person, we communicate feedback so it is impossible not to provide one. • It boosts learning: Feedback is important to remain focussed on goals, plan better and develop improved products and services. • It improves performance: Feedback can help to form better decisions to improve and increase performance.	2
8	Write down the common communication barriers you may come across when you move to a new city or country. Ans:	2

	When we are moving to a new country we may come across: - Cultural barriers: when people of different cultures are unable to understand each other's customs, resulting in inconveniences and difficulties. Linguistic Barriers: Language barriers are the most common communication barriers, which cause misunderstandings and misinterpretations between people when in a new country or city.	
9	Name the four main categories of Communication Styles. (CBSE 2020-21) Verbal, Non - Verbal, Written and Visual	2
10	Draw any two common signs used for Visual Communication. Explain what each conveys and where did you see it?  a) No parking Sign. Seen before gates of houses and on areas where parking is not allowed. b) Danger warning. Could be seen in places of Potential danger like in a waterfall during rainy season, Rough sea etc	2
11	Classify the following actions below as examples of bad and good non-verbal communication a) Laughing during formal communication b) Scratching head c) Smiling when speaking to a friend d) Nodding when you agree with something	2
12	List down the various elements of Communication Channel. Ans: The various elements of a communication cycle are: Sender: the person beginning the communication. Message: the information that the sender wants to convey. Channel: the means by which the information is sent. Receiver: the person to whom the message is sent. Feedback: the receiver's acknowledgement and response to the message.	2
13	Mention 2 positive facial expressions which you can use in making effective communication. Ans: • Smiling when meeting someone. • Keeping face relaxed. • Matching expressions with your words. • Nodding while listening.	
14	List down the basic parts of speech. Ans: The part of speech indicates how a particular word functions in meaning as well as grammatically within the sentence. Some examples are nouns, pronouns, adjectives, verbs and adverbs.	
15	Write two sentences of each type of sentence—statement, question, exclamatory and order.	

	Examples: - Statement: 1.The sun rises in the east 2. The earth revolves around the sun Question: 1.What is a solar eclipse? 2.Do you know where he is? Exclamation: 1. Alas We lost the match! 2. Hurray!!! Tomorrow is a holiday Order: 1.Please lower your voice 2. Meet me at my office.	

UNIT-2: SELF-MANAGEMENT

COMPONENTS OF SELF MANAGEMENT



Self-Management:

Self-management is the ability to control one's emotions, thoughts and behaviour effectively in different situations.

Essential Skills for Success:

Discipline	Punctuality	Goal -setting	Teamwork	Problem Solving
	Responsibility	Adaptability	Professionalism	
		Dedication		

Importance of Self-Management:

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

Methods of Self-Management

Stress: Stress can be defined as emotional, mental, physical and social reaction to any perceived demands or threats.

Symptoms of Stress:

Sign of Physical stress	Sign of Mental stress
Breathlessness	Irritation
Indigestion	Boredom
Fatigue	Mood swings
Cold hands and feet	Loneliness
Dry mouth or choking feeling	Anxiety
Nausea	
Sweaty palms	

Causes of Stress:

- Lack of confidence
- Work pressure
- Physical discomfort
- Conflict or rivalry,
- Meeting deadlines or expectations
- Change of routine

Effects of Stress:

- Deteriorates mental and physical health
- Lack of concentration and productivity in work
- Damage in personal and professional relationships

Stress Management:

Managing stress is about planning to cope effectively with daily pressures.

Advantages of Stress Management:

- ✓ Focus and Goal-setting
- ✓ Better planning

- ✓ Execute the work smoothly within deadline
- ✓ Better work-life balance

Methods of Stress Management:

- **Step 1:** Awareness about stress
- **Step 2:** Identify the cause of stress
- **Step 3:** Apply Stress management techniques

Stress Management Techniques:

1) Proper time management
2) Physical exercise, Yoga, balanced diet, and healthy lifestyle
3) Maintain positive attitude and outlook
4) Organise schedule, complete all the works on time
5) Adequate sleep and relaxation
6) Spending quality time with friends and family.

Self-Awareness

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

Realising Strength and Weakness:

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

SWOT Analysis: SWOT analysis is an important framework for identifying and analysing the ***Strengths, Weaknesses, Opportunities,*** and ***Threats***.

Self-Motivation:
Self-motivation is the internal force that drives one to act towards achievement of goals.

Types of Motivation:

Internal Motivation	Self-interest and love for the work or hobby

- Doing task of own interest makes one happy, healthy and feel good.

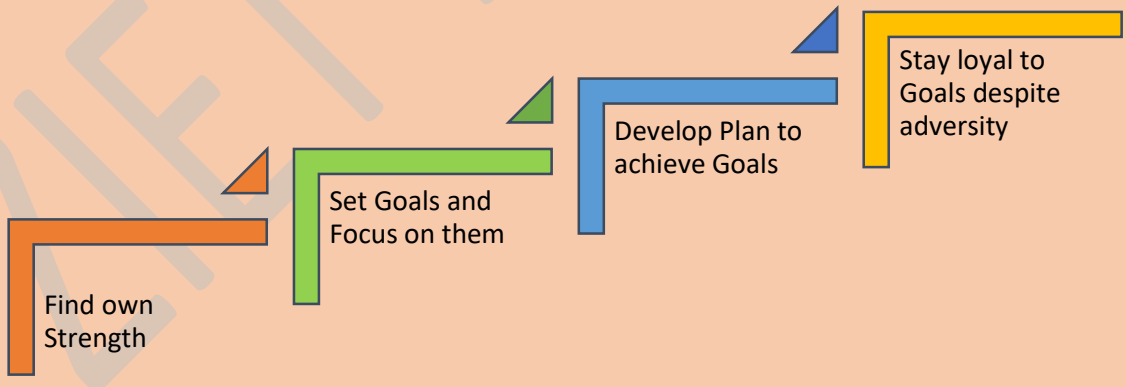
External Motivation	Reward

- Doing the task brings respect, recognition and appreciation

Qualities of Self-Motivated People:

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

Steps to Build Self-Motivation:



Self-Reliance - Ability to Work Independently

Importance of The Ability to Work Independently

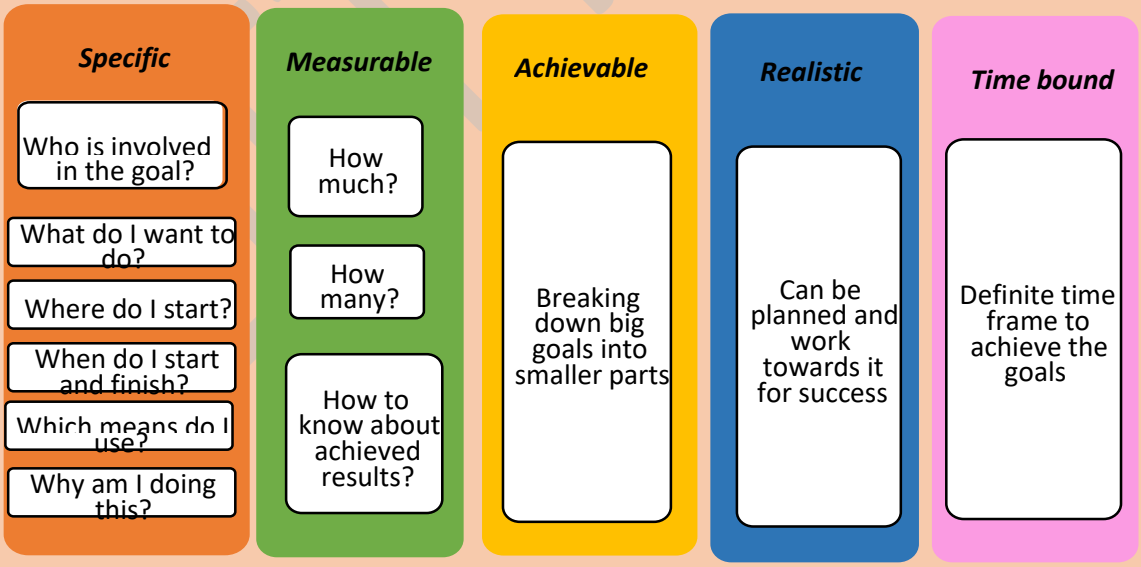
Following benefits of working independently advocate its importance.

- Ensures greater learning.
- Individuals feel more empowered and responsible.
- It provides flexibility to choose and define working hours and working mechanisms.
- Failure and success of the task assigned are accounted by individuals.
- Individuals become assets to organizations, groups and nations at large.
- It ensures creativity and satisfaction amongst individuals.

Goal Setting

- **Goals:** Goals are a set of dreams with a deadline to achieve them.
- **Goal Setting:** Goal setting is all about finding and listing one's goals in life and planning on achieving them.
- **Importance of Goal Setting:**
  - o Helps to think and decide about future plans o Helps to prioritize things in life o Helps to focus on important tasks

Nature of Goals: **SMART**



Time Management:

Time management is the ability to plan and control on spending time in order to complete all the intended work.

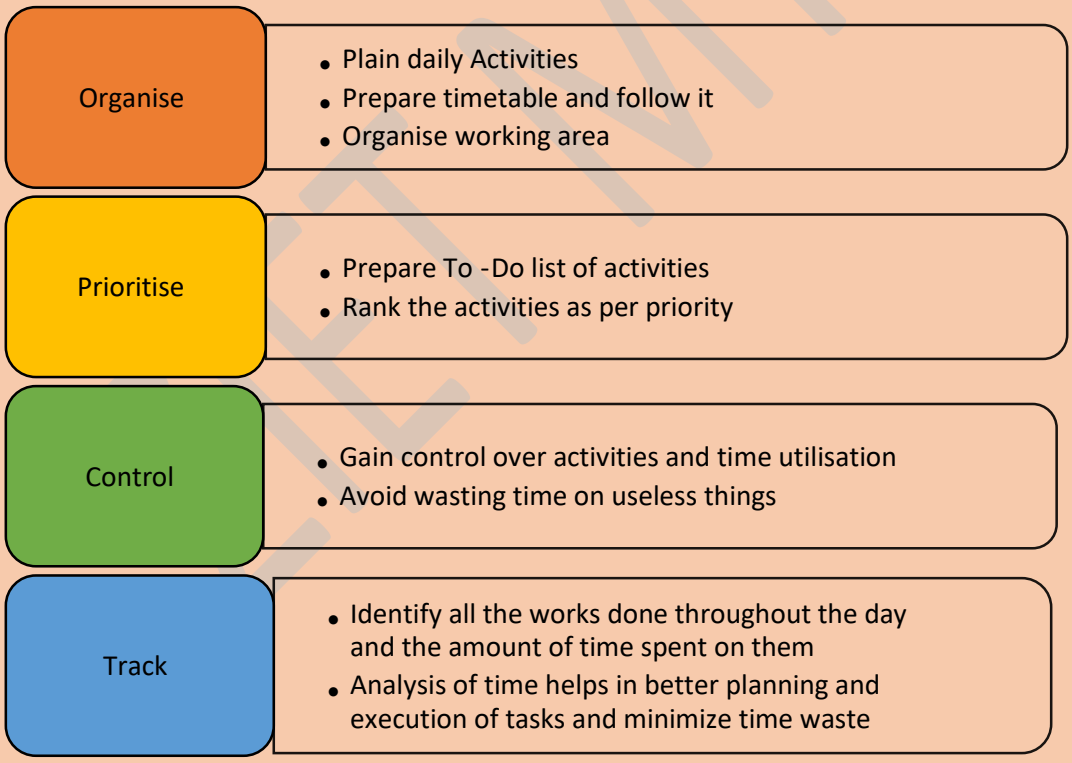
Benefit of Time Management:

1. Timely completion of tasks
2. Prepare and follow a daily timetable
3. Correct estimation about duration of a work
4. Correct utilisation of time
5. Sense of accomplishment resulting satisfaction and happiness

Healthy habits for Time Management:

1. Avoid unnecessary delay or postpone of planned activity
2. Organise the workplace to develop good working environment
3. Utilise leisure and waiting time productively
4. Prepare To-Do list and prioritise works
5. Develop healthy habits and productive hobby

Steps for Effective Time Management:



Emotional Intelligence:

Emotional intelligence is the ability to identify and manage own and others' emotions.

Steps to Manage Emotions:

1.Understand emotions: Observe behaviour
2.Rationalise: Think judiciously, then decide and act
3.Control: Practice Yoga and meditation to keep calm

Quality of a good Team Member:

i. Work towards a common Goal set by the team
ii. Selflessness - Help and Adjust with the group
iii. Good interpersonal skills
iv. Team spirit and group management skills

Quality of Independent workers:

i. Self-awareness, self-monitoring and self-correcting
ii. Awareness of Goal
iii. Taking initiative
iv. Recognising mistakes and self-performance analysis
v. Continuous learning

Personality Management:

Personality includes proper sense of dressing, personal hygiene, and good communication skills to have positive impression on others.

	ONE MARK QUESTIONS	
1	1.Which of the following activities helps in reducing stress? a) Yoga b) Walking c) Meditation d) All of these	1
2	_____refers to focusing human efforts for maintaining a healthy body and mind capable of better withstanding stressful situations. a) Mental Health b) Emotional Health c) Self-Management d) Stress Management	1
3	_____ is a series of postures and breathing exercises practiced to achieve control of body and mind. points a. Meditation b. Nature Walk c. Yoga d. drill	1
4	Pranjali gets up at 5 am and goes to her badminton classes. Then she comes home and finishes her homework before going to school. She does this all by herself. No one tells her to do it. This is an example of (a) Self-motivation (b) External motivation (c) Both self and external motivation (d) Not any specific type of motivation	1

5	Statement 1: A realistic goal is one that has no timeline or plans for execution. Statement 2: Breaking down big goals into smaller parts will make the goal achievable. a) Both Statement I and Statement II are correct b) Both Statement I and Statement Il are incorrect c) Statement I is correct but Statement II is incorrect d) Statement I is incorrect but Statement II is correct	1
6	_____ the work is all about identifying and noting how we spent our time, and analysing how to spend our time effectively. (CBSE 2023-24) (a) Organising (b) Prioritising (c) Controlling (d) Tracking	1
7	SMART method can be used to set goals to make you successful in your career and personal life. What does 'A' in SMART stand for? (CBSE 2023-24) (a)Abrupt (c)Achievable (b)Accountable (d)Admirable	1
8	Which of the following is not a key element of self-management skills? (a)Prioritising your work (b)Not taking feedback (c)Goal setting (d)Staying updated about new practices	1
9	Sonika gets up at 6 am and goes for her hobby classes. Then she comes back home and finishes her homework before going to school. She does all work by herself. No one tells her to do so. This is called _____. a. Self-Awareness b. Self-Motivation c. Self-Regulation d. Discipline	1
10	High expectations from self can leave one with chronic anxiety and stress, thus leading to _____stress. a. Physical b. Emotional c. Mental d. Financial	1

11	EXPAND 'S.M.A.R.T 'w.r.t to goal setting.	1
12	Gathering insights on your personality and work-specific proficiencies is known as (a) responsibility (b) self - awareness (c) adaptability (d) time management	1
13	What are the ABC of Stress Management? (CBSE 2022-23) a) Avertible, Belief, Consequences. b) Adversarial, Being, Control, c) Adversity, Belief, Consequences d) Adversity, Belief, Control	1
14	Which of the below is not a step of Effective Time Management? (CBSE 2022-23) a) Organize b) Prioritize c) Control d) Remember	1
15	Managing stress is about making A) A Plan to visit Psychologist. B) A plan to develop emotional stability. C) A plan to be able to cope effectively with daily pressures. D) A plan to fun trip	1

ANSWERS:

1. d) All of these	2. d) Stress Management	3. c. Yoga	4. (a) Self-motivation	5. d) Statement I is incorrect but Statement II is correct
6. (d) Tracking	7.(c)Achievable	8. (b)Not taking feedback	9. b. Self-Motivation	10. c.Mental
11.Specific, Measurable, Achievable, Realistic,Time bound	12. (b) self - awareness	13. c) Adversity, Belief, Consequences	14. d) Remember	15. C) A plan to be able to cope effectively with daily pressures.

	TWO MARK QUESTIONS- SELF MANAGEMENT SKILLS	
1	What is stress? Enlist few simple stress management techniques.	
2	In SMART goals, what does 'S' stand for? Explain.	
3	Mention any two benefits of working Independently.	
4	List down any two methods that can be followed for effective time management.	
5	What is the importance of setting goals in life?	
6	What are the factors that affect self-confidence?	
7	Sameera is always punctual at school. She has a regular schedule that she follows every day. She plans for study and play time in advance. Enlist the four steps Sameera must have followed for effective time management. (CBSE 2022-23)	
8	What are the 2 types of motivation?	
9	What is the best way to work on long-term goals?	
10	What is Time Management?	
11	How can tracking your time help you?	
12	Raghu always schedules all the activities he has to complete in a day. What is he doing? Elaborate on that quality you see in Raghu which you can imbibe.	
13	Describe the steps of gaining self-motivation.	

14	Disha is going to start a new business with own investment. What qualities she should possess to work independently?	
15	Mention any two symptoms of stress.	
	TWO MARK ANSWERS - SELF MANAGEMENT SKILLS	
1	What is stress? Enlist few simple stress management techniques. Stress can be defined as our emotional, mental, physical and social reaction to any perceived demands or threats Here are a few simple stress management techniques. (Any two) a) Time management b) Positivity c)Physical Exercise and Fresh Air d)Healthy Diet e) Holidays with Family and Friends f) Good Sleep g) Organising your work and not delaying	
2	In SMART goals, what does 'S' stand for? Explain. We can use SMART method to set goals. SMART stands for: • Specific: A specific and clear goal answers six questions. Who is involved in the goal? What do I want to do? Where do I start? When do I start and finish? Which means do I use? Why am I doing this? Not a specific goal: "I would learn to speak English." Specific goal: "I would learn to speak English fluently by joining coaching classes after my school every day, and in six months I will take part in the inter-school debate competition."	
3	Mention any two benefits of working Independently. Two benefits of working independently 1. Ensures greater learning	

	2. Individuals feel more empowered and responsible	
4	List down any two methods that can be followed for effective time management. Tips for Practicing Effective Time Management • Avoid delay or postponing any planned activity • Organise your room and school desk • Develop a 'NO DISTURBANCE ZONE', where you can sit and complete important tasks • Use waiting time productively • Prepare a 'To-do' list • Prioritise • Replace useless activities with productive activities	
5	What is the importance of setting goals in life? Following are the importance of Goal setting1. Goals allow you to separate out what's important. 2. It helps you to focus on the end result instead of less Important work. 3. This will make you successful in your Career and personal life.	
6	What are the factors that affect self-confidence? Answer- Factors that affect self-confidence are: - a) When we think we cannot do a particular work. b) When we keep thinking of our past mistakes and feel bad about it, instead of learning from them. c) When we expect to be successful at the first attempt itself and do not try again. d) When we are surrounded by people who have a negative attitude, which is reflected in their speech	
7	Sameera is always punctual at school. She has a regular schedule that she follows every day. She plans for study and play time in advance. Enlist the four steps Sameera must have followed for effective time management. (CBSE 2022-23) The four steps of effective time management which Sameera must	

	have followed are: (i) Organise (ii) Prioritise (iii) Control (iv) Track	
8	What are the 2 types of motivation? Internal Motivation: LOVE We do things because they make us happy, healthy and feel good. For example, when you perform on your annual day function and you learn something new, such as dancing, singing, etc., you feel good. External Motivation: REWARD We do things because they give us respect, recognition and appreciation. For example, Suresh participated in a 100m race and won a prize. This motivated him to go for practice every morning.	
9	What is the best way to work on long-term goals? The best way to work on long-term goals is: • Commit to one long-term goal at a time. • Break your goal into sub-goals. • Set up a timetable for your goal and sub-goals. • Work on your self-discipline. • Develop habits that aid in accomplishing your goal. • Review your progress regularly. • Take breaks regularly. • Try to make your goal fun. • Celebrate your successes	
10	What is Time Management? Time management is the ability to plan and control how you spend the hours of your day well and do all that you want to do. An example of good time management skills would be when you decide to finish your homework immediately after school so you have time to watch TV later in the evening.	
11	How can tracking your time help you?	

	Tracking your time helps you gain perspective on your life, so you can determine whether the way you spend your time is true to your priorities and what is important to you. By tracking your time, you can i. See how many hours you work. ii. Discover what your priorities are. iii. Time feels richer. iv. A time log can lead to real change.	
12	Raghu always schedules all the activities he has to complete in a day. What is he doing? Elaborate on that quality you see in Raghu which you can imbibe. Ans: Raghu is managing his time effectively by scheduling and planning the activities he has to complete in time. Time management is the ability to plan and control how you spend the hours of your day well and do all that you want to do. The effective time management techniques that we can imbibe from Raghu are: - a) Organise b) Prioritize c) Control and d) Track	
13	Describe the steps of gaining self-motivation. Step 1: Find own Strength Step 2: Set goal and focus Step 3: Plan and work Step 4: Stick to the goal	
14	Disha is going to start a new business with own investment. What qualities she should possess to work independently? • Self-awareness – Know strength, weakness, risk, opportunity • Define Goals, take initiative to plan and work • Self-performance analysis, recognising mistake • Continuous learning from surroundings	

15	Mention any two symptoms of stress. (Any two) • Breathlessness • Irritation • Indigestion • Boredom • Fatigue • Mood swings • Cold hands and feet • Loneliness • Dry mouth or choking feeling • Anxiety • Nausea • Sweaty palms	

TYPES OF OPERATING SYSTEMS

An Operating System (OS) is an interface between a computer user and computer hardware. An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

Some popular operating systems are:

- DOS (Disk Operating System)
- Windows It is an operating system developed by Microsoft.
- Linux It is an operating system designed for personal computers. It is a free and OpenSource Software
- Mobile operating Systems
    - ✓ Android
    - ✓ Symbian
    - ✓ Windows Phone
    - ✓ iOS

Following are some of important functions of an operating System.

- Memory Management
- Processor Management
- Device Management
- File Management
- Security
- Control over system performance
- Job accounting

• Error detecting aids

The different types of operating systems are as follows:

Interactive (GUI-based) A graphical user interface is a user-friendly operating system in which commands can be entered by clicking/double-clicking/right-clicking a mouse. Windows operating system is an example of an interactive operating system.

Single-user, single-task operating system: This type of operating system allows only one user to do a task on the computer and one thing at a time.

Single-user, multi-task operating system: This type of operating system is used on Desktop computers, laptops, where a single user can operate on several programs at the same time. For example, Windows, Apple MacOS are examples of single-user multi task operating system.

Multi-user: A multi-user operating system enables multiple users to work on the same computer at different times or simultaneously.

Real Time: A real time operating system is used to control machinery, scientific instruments, like robots, in complex animations and computer controlled automated machines. A real-time operating system is a computing environment that reacts to input within a specific period of time. It manages the resources of the computer so that any particular operation is executed in the same amount of time every time it is executed.
Windows CE and Lynx OS are examples of real-time operating systems.

Distributed: A distributed operating system runs on a set of computers that are interconnected by a network. It combines the different computers in the network

into a single integrated computer and storage location. Windows, UNIX, and LINUX are examples of distributed operating systems.

Windows 7 operating system:

Windows 7 is an operating system developed by Microsoft and is used on personal computers. After loading Windows 7, the first screen that appears on the monitor is called desktop. From the desktop, you can access different components of Windows 7.

By default, Windows 7 has a picture for the desktop background. This is called wallpaper.

Small pictures on the desktop are called icons. These icons represent files, folders, 31applications, etc. At the bottom of the desktop is a long bar called the Taskbar. To the left ofthe taskbar is the Start button.

File Concept, File Operations, File Organization, Directory Structures And File SystemStructures

Everything you store on your computer is stored in the form of a file. There are specific naming conventions for naming files or folders, like characters that can be used, maximum number ofcharacters, etc. Files can be separately placed into groups, called folders/directories. Each directory/folder can contain related files and/or sub-folders.

CARE AND MAINTENANCE OF COMPUTER

Regular maintenance of the computer system is very important.

Some of the maintenance activities are:

- Keep the components of the computer, like keyboard, mouse, monitor, etc. clean.
- Replace hardware that is not functioning properly
- Keep food items away from the computer
- Cables and chords should not be messed up

- Removing unauthorized software from the computer
- Take regular backup of the data
- Ensure backups are working properly by periodically restoring or checking of data. Youshould use external hard drive for backup of data on your computer.
- Run anti-virus periodically
- Keep anti-virus software up to date
- Do not overcharge the batteries
- Do not block the vents
- Always shut down the computer properly

	Section -A (1 Mark Questions)	
Q1.	One of the most important contributions of ICT in the field of education……. a. Easy access to teaching b. Easy access to books c. Easy access to learning d. Easy access to workload Ans: c	**1**
Q2.	Internet Explorer is a ……... a. Internet b. Web browser c. Search Engine d. Service Provide Ans: b	**1**
Q3.	ICT stands for: a. Inter Connected Terminals b. Intra Common Terminology c. International Communication Technology d. Information and Communication Technology Ans: d	**1**
Q4.	Physical part of computer is called . . . . a. Hardware b. Software c. Shareware d. None of the above	**1**

	Ans: a	
Q5.	Software that starts working as soon as we switch on a computer is a. RAM b. ROM c. Operating System d. None of the above Ans: c	**1**
Q6.	_____ act as an interface between the user and the computer. a. Operating System b. MS Excel c. Impress d. Digital Documentation Ans: a	**1**
Q7.	Which of the following is a valid file extension for Notepad file? a. .jpg b. .doc c. .text d. .txt Ans: d	**1**
Q8.	How can an antivirus protect your device? a. It can protect it from overheating. b. It can increase its performance. c. It can prevent data from getting corrupt. d. It can backup data. Ans: d	**1**
Q9.	Which of the following is essential for maintaining a keyboard? a. Turn the keyboard upside down and shake it to remove foreign material. b. Blow dust and other particles with help of a blower. c. Use a very dilute combination of soap and water applied with a non-abrasive cloth to remove stains from the keycaps. d. Cover the keyboard whenever not in use Ans: c	**1**
Q10.	When the information is stored or recorded on electronics device, refers to a. Raw form b. Digital form c. Paper form d. None of the above Ans: b	**1**
Q11.	Manisha pressed a key on keyboard that moved the cursor to the beginning of a new line but she did not know which key has been presses	**1**

	by her. Identify the key pressed by her: a. Enter b. Shift c. Ctrl d. Windows Ans: a	
Q12.	Which of the following is not an advantage of cyber security? a. Makes the system slower b. Minimizes computer freezing and crashes c. Gives privacy to users d. Protects system against viruses Ans: a	**1**
Q13.	In which of the following, a person is constantly followed/chased by another person or group of several peoples? a. Phishing b. Bulling c. Stalking d. Identity theft Ans: c	**1**
Q14.	_____ is a type of software designed to help the user's computer detect viruses and avoid them. a. Malware b. Adware c. Antivirus d. Both B and C Ans: c	**1**
Q15.	It is the set of programs that enables your computer's hardware devices and application software to work together a. Management b. Processing c. System Software d. Utility software Ans: c	**1**

Section -B (2 Mark Questions)		
Q16.	What do you mean by ICT term? Ans: ICT stands for Information and communication technology. It refers to all the tools related to storing, recording and sending digital information.	**2**
Q17.	How can we increase the performance of a computer? Ans: We can increase the performance of system by: 1. Using an updated Antivirus 2. Removing unnecessary files and data such as temporary files and images.	**2**
Q18.	Rama is eager to know about the use of ICT, especially the role of ICT in education, so help her to know more about this term. Ans: Information and Communication technology (ICT) play a significant role in all aspects of modern Society. ● ICT enables use of innovative resources and renewal of learning methods. ● It establishes a more active collaboration of students. ● Simultaneous acquisition of technical knowledge.	**2**
Q19.	Ravi wants to know about the benefits and flaws of ICT, so help him by writing the advantages and disadvantages of Information and Communication technology. Each digital device contains its advantages and disadvantages. Advantages of ICT: ● Enhanced the modes of communication. ● Better teaching and learning methods ● Paperless technique Disadvantage of ICT: ● Teacher requires experience to handle ICT ● Traditional books and handwritten methods at risk ● Risk of Cyber-attack and hacking	**2**
Q20.	Aisha is searching some contents related to sports in search engine but during searching help her about how to prevent her data while using the internet? Ans: To protect the data following measures should be take care: ● Use a strong password in your account. ● Install antivirus and firewall ● Keep the information in encrypted format ● Click only on secure websites during internet surfing.	**2**

Q21.	How to maintain a computer system? Ans: For maintenance of the system keep the following points in mind: ● Keep the devices clean such as keyboard, screen, CPU etc. ● Prepare a maintenance schedule such as daily or weekly.	**2**
Q22.	List the various threats to a computer and its data. Ans: The various threats to a computer and its data: ● Virus ● Phishing ● Online theft ● Cyber crime ● Hacking	**2**
Q23.	Write the functions of the operating system Ans: The following are the functions of operating system: ● It checks whether the device is functioning properly. ● It controls all the software resources. ● It manages computer memory. ● It allows you to create, copy and delete files.	**2**
Q24.	Seema is using a laptop and trying to copy data from pen drive but she does not know about how a system gets affected with virus so help her by mentioning a few ways how the system gets infected with virus. Ans: A computer can gets affected with virus in any following ways: ● Infected files ● Infected pen drives ● Infected CD ROM /DVD ROM ● Through infected files attached in emails	**2**
Q25.	Define hardware and software in Computer systems. Ans: Hardware refers to the physical and visible components of the system such as a monitor, CPU, keyboard and mouse. Software: Software refers to a set of instructions which enable the hardware to perform a specific set of tasks. Software is a generic term used to refer to applications, scripts and programs that run on a device.	**2**
Q26.	Why is the CPU calling the “Brain of a computer”? Ans: The CPU is called as Brain of the computer" because the Central Processing Unit (CPU) is responsible for executing instructions and performing calculations in a computer. It acts as the brain of the computer by controlling and coordinating all the operations of the system, including processing data, running programs, and managing hardware resources. Without a CPU, a computer would not be able to function and perform	**2**

	task.	
Q27.	Define antivirus and what is the use of antivirus. Ans: Anti-virus software is a program that protects your email, files, and downloads attached to software. ● It scans and detects potential threats such as viruses, malware, and spyware, preventing them from infecting your system. ● It also provides real-time protection by constantly monitoring your computer for any suspicious activity. ● By regularly updating its virus definitions, it can identify and remove the latest threats	**2**
Q28.	Rishi wants to categorize different types of devices so help him to list any four input, output and storage devices which are used in day to day life. Ans: Input Devices: Keyboard, Mouse, Scanner, Microphone Output Devices: Monitor, printer, plotter, Speaker Storage Devices: Hard Disk, CD/DVD, Pen Drive, Memory card	**2**
Q29.	How to delete files and folders permanently from the recycle bin window? Ans: 1. Double click on the Recycle bin 2. The Recycle bin window appears 3. Click empty the Recycle	**2**
Q30.	Ravish wants to change his phone but he wants to transfer his old data for later use so suggest him the term regarding this process. Ans: The process through which Ravish can transfer his old data for later use is known as data backup. Backing up data means to save the information present on your computer on another device, such as CD/DVD drives or hard disk.	**2**

UNIT-4: ENTREPRENEURIAL SKILLS

MIND MAP:

Topic 1- Entrepreneurship and Society

Entrepreneurs' Contribution to Society

- Improve Standard of Living
- Wealth Creation
- Accelerate Economic Growth
- Create Jobs
- Bring efficiency in society
- Bring more choices to customers

Topic 2- Qualities and Functions of an Entrepreneur

Qualities	Functions
Confidence	Decision Making
Innovation	Business Management
Calculated Risk Taking	Financial Management
Creativity	Risk Analysis
Patience	Setting Vision for Organisation
Perseverance	Efficiency in Operations
Leadership	Sustenance of Business

Topic 3- Myths about Entrepreneurship

1. Every business idea needs to be unique or special.
2. A person needs a lot of money to start a business.
3. Only a person having a big business is an entrepreneur.
4. Entrepreneurs are born, not made.

Topic 4- Entrepreneurship as a career option

Advantages	Disadvantages
Independence	Risk
Ambition Fulfilment	Excessive Workload
Wealth Creation	Uncertainty
Work-Life Autonomy	Challenges

Topic 1- Entrepreneurship and Society

Contribution of Entrepreneurs towards Society

- **Fulfil Customer Needs**: Entrepreneurs find out what people want. Then, they use their creativity & innovation to come up with a business idea that will meet that demand and satisfy customer needs
- **Use Local Materials**: Entrepreneurs use locally sourced material and workforce available around them, to make products at least cost. This ensures business efficiency.
- **Create Jobs**: With the growth of a business, entrepreneurs look for more people to help them. They buy more material. They also hire more people to work for them, thereby providing livelihood opportunities to others.
- **Bring down cost of goods and services**: As more entrepreneurs sell the same product, the price of the product goes down due to innovation and market competition.
- **Improve Standard of Living**: With newer and better products, standard of living of common man rises and everyone experiences better life.
- **Increase Economic Pie**: As entrepreneurs grow their business, the people working for them and they themselves too become wealthy. This helps increase nation's economic growth.

Topic 2- Qualities and Functions of an Entrepreneur

Qualities of an Entrepreneur

- **They are confident:** Entrepreneurs are confident beings. They decide to take up a venture and it is their confidence that ensures survival and success of their idea.
- **They try new and innovative ideas**: Entrepreneurs introduce new and innovative ideas in the market. Sometimes, such ideas may even displace the inefficient players from the market.
- **They are creative:** Entrepreneurs are creative people. They always try to find opportunities for a better product/service through their creativity.
- **They show patience:** Entrepreneurs are resilient people. They wait till the venture succeeds. This quality also helps them deal effectively with their employees.

- **Perseverance:** Entrepreneurs show perseverance as any small hurdle doesn't stop them from achieving their ambitions. They keep on working towards fulfilment of their ambition.
- **Takes responsibility:** Entrepreneurs take responsibility to successfully execute the business idea into a full-fledged profit-making enterprise.
- **Have leadership Skills:** Entrepreneurs are leaders as well. They have the responsibility to lead the venture towards its Organisational Vision. Further, they also lead the team of employees and guide them to work effectively towards Organisational Goals.
- **Hard working:** Entrepreneurs work hard, especially in the initial phase of venture. This quality ensures that they keep on working with passion and dedication.
- **Take calculated risk:** Entrepreneurs take calculated risk, which pays them off well as they always keep in mend the Risk-Reward ratio.
- **Never Give Up spirit:** Entrepreneurs don't give up easily. This persist with their efforts and always try to turn things around.

Functions of an Entrepreneur

- **Making Decisions:** Decision making is part of everyday routine of an entrepreneur. Decision make include a Technical Decision, Managerial Decision, Administrative Decision or even a Strategic Decision. Decision making by entrepreneurs is often based on risk-reward ratio, feedback from market, customer demand and offerings by the competition.
- **Managing the Business:** Entrepreneurs often plan a vision for the venture and in order to achieve it, they try to manage the business well as only a well-managed business can sustain in the long run.
- **Keep track of Finances:** Entrepreneur keeps track of whom to pay how much and what for. They pay the employees' salaries, service providers, suppliers' payments, etc.
- **Taking Risk:** Entrepreneurs take risk, though a calculated one. They

factor-in all variables & risks before reaching to a decision. A calculated risk pays off well as its risk-reward ratio is not too skewed.

- **Create a New Method, Idea OR Product:** Entrepreneurs introduce new and innovative ideas in the market. Sometimes, such ideas may even displace the inefficientplayers from the market.

Topic 3- Myths about Entrepreneurship

What is a misconception?

A myth, or a misconception, is a false belief or opinion about something.

Misconception 1: Every business idea needs to be unique or special

- A person can take an idea that is already there in the market and do something differentwith it.
- For example: Cab Service named 'inDrive' simply introduced an option wherein a usercan quote his/her fare and negotiate with cab driver. This is unlike stand Cab Service providers like 'Ola' and 'Uber'

Misconception 2: A person needs a lot of money to start a business

- Capital is important for starting. However, every business does not need a lot of capitalto start. Moreover, today there is no dearth of credit and even venture capitalists are willing to provide funding.
- Depending on how much money you have or can borrow, you can start a business with that much money. Once you make more money, you can reinvest profits back into yourbusiness to make it bigger.
- For example: 'BTW' or "Bittoo Tikki Wala" initially started as a street seller and later on expanded based on reploughing of profits back into business.

Misconception 3: Only a person having a big business is an entrepreneur

- No business is big or small. If a person is running a business to fulfil a customer need, they are an entrepreneur from Day 1. Most businesses

start small. It becomes big withhard work and creativity, over time.

Misconception 4: Entrepreneurs are born, not made.

- It is only a myth that some people have the talent for doing business. An entrepreneur is a person who does whatever it takes to make the business successful. Being an entrepreneur starts with a way of thinking. Moreover, entrepreneurial skills cam be developed too through training.

Topic 4- Entrepreneurship as a career option

A person who chooses to become an entrepreneur goes through a career process. This processis as follows:

- **Entry**: When an entrepreneur is starting, they are just entering the market to dobusiness
- **Survival**: There are many entrepreneurs in the market. The entrepreneur has to survive in a competitive market. This is the most crucial phase for an entrepreneur.
- **Growth**: Once the business is stable, an entrepreneur thinks about expanding his orher business.

Advantages of choosing entrepreneurship as a career option are:

A) Independence

- An entrepreneur is not dependent on anyone for his/her livelihood. He/she isself-reliant

B) Ambition Fulfilment

- Entrepreneurship helps fulfil one's ambition and passion simultaneously.Hence, the entrepreneur feels self-satisfaction

C) Wealth Creation

- Entrepreneurs are the wealth creators in the economy. They help expand theeconomy of the nation through their innovative ideas.

D) Work-Life Autonomy

- An entrepreneur enjoys work-life autonomy as he/she is one's own boss andhas full freedom to decide one's working hours.

Disadvantages of choosing entrepreneurship as a career option are:

A) **Risk:**

- Contrary to wage employment, one has to risk one's own savings, time and efforts

B) **Workload:**

- It takes serious hustle to get a new business up and running from scratch. While it can be an exciting time, full of possibility, it can also be exhausting for an entrepreneur.

C) **Challenges:**

- Being an entrepreneur is not without its challenges. One may face lonely weekends and late-night works. Further low funding in initial stages may also lower chances of success of the venture.

D) **Uncertainty**:

- Entrepreneurs often face headwinds from various quarters. Change in market dynamics, government policies or even consumer preferences, all can affect survival chances of a venture.

SECTION A: OBJECTIVE TYPE QUESTIONS

Q.	Answer the given questions on Entrepreneur Skills (1 Mark each)	
1.	The process of developing a business plan, launching and running a business using innovation and meet customer needs and to make profit is _____. Software Engineer *Entrepreneurship* Civil Engineer Mechanical Engineer	1
2.	What is the aim of entrepreneurship? Earn a profit Solve customers need innovatively *Both of the above* None of the above	1
3.	Entrepreneurs create _____ opportunities to grow the economy of the country. *Business* Credit Money None of the above	1
4.	Qualities of a entrepreneurs are Never Giving up Hardworking Perseverance *All of the above*	1
5.	There are various natural resources present around us _____. Entrepreneurs keep working to find the most optimal ways of using the resources to reduce costs and increase their profits. Renewable Non-renewable *Both a and b* None of the above	1
6.	Ritu leaves the company she worked for and starts catering food for marriage programmes. She is an _____. *Entrepreneur* Employee Cook	1

	Unemployed	
7.	Ravi's customer comes to his store and starts shouting at him. He does not get angry. He listens to what his customer is saying. He is _____. Hardworking Confident *Patient* Trying new ideas	1
8.	Susheela decides to sell her company tyres in Sri Lanka. It does not sell and she has a loss. She apologises to the people who work for her. She says she will plan better next time. She _____ . *takes responsibility for her mistakes* thinks before deciding does not give up is creative	1
9.	_____ are people who work for a person or an organization and get paid for that work. Self employed *Wage employed* Both of the above None of the above	1
10.	The money used to start a business is called _____ . *Capital* Business Money Start ups None of the above	1
11.	Which of the following are misconception about Entrepreneur? a. Entrepreneurs are born, not made. b. A person having a big business is an entrepreneur. c. A person needs a lot of money to start a business. *d. All of the above*	1
12.	A self-employed person who is always trying to make his/her business better by taking risks and trying new ideas is called _____ . Skilled man Business man *Entrepreneur*	1

	None of the above	
13.	Positive impact of entrepreneurship on society is _____ Accentuates economic Growth Encourages welfare of the society Solves the problems of the society *All of the above*	1
14.	Dr. Ravi has his own clinic so he is a _____ Person. *Self-employed* Wage-employed Both of the above None of the above	1
15.	Benefits of Entrepreneurship Do what you are interested in Make profits for your self More risk, more profit *All of the above*	1
	TWO MARKS QUESTIONS	
1.	Who is an entrepreneur? Ans: An entrepreneur is a person who is self-employed, is willing to take a calculated risk and brings in a new idea to start a business.	2
2.	How do entrepreneurs help in growing the area and society they live in? Ans: Entrepreneurs run their businesses in a market. The market has people who buy products and services and people who sell them also. When people are buying and selling from each other, it is helpful for everyone because everyone involved makes money. This is how entrepreneurs help in growing the area and society they live in.	2
3.	List two qualities of successful Entrepreneurs. Ans) They are confident. They believe in themselves and their abilities. • They keep trying new ideas in their business. • They are patient. • They are creative and think differently about business ideas. • They take responsibility for their actions. (Any two Points)	2

<table>
<tr><td>4.</td><td>Differentiate between waged employee and self-employed people.
Ans) Waged employed people are people who work for a person or an organization and get paid for that work. Self-employed people are those who start businesses to satisfy the needs of people.</td><td>2</td></tr>
<tr><td>5.</td><td>What do entrepreneurs do when they run their business?
Ans:
1. Fulfil Customer Needs
2. Use Local Materials
3. Help Society
4. Create Jobs
5. Sharing of Wealth
6. Lower Price of Products
(Any four points)</td><td>2</td></tr>
<tr><td>6.</td><td>What is the difference between a misconception and reality?
Ans) Misconception: A myth, or a misconception, is a false belief or opinion about something.
Reality: Reality means the things which actually exist. In other words, reality is all the things which has real existence irrespective of appearance or not.</td><td>2</td></tr>
<tr><td>7.</td><td>Match each story below with the misconception about entrepreneurship.<table><tr><th>Story</th><th>Misconception</th></tr><tr><td>Ramu owns a large clothes shop. Shamu has a small store selling handmade sarees. Shamu does not call himself an entrepreneur.
Ans: c</td><td>a) Every business idea needs to be unique or special.</td></tr><tr><td>Anna has a great idea for a website. She has 5,000. She is waiting for 20,000 more, so that she can start it.
Ans: b</td><td>(b) Entrepreneurs are born, not made.</td></tr><tr><td>In a city of thousands of tailoring shops, Gauri is a tailor who stitches good quality clothes and has a very successful business.
Ans: a</td><td>(c) A person needs to have a big business to be called an entrepreneur.</td></tr></table></td><td>2</td></tr>
<tr><td>8.</td><td>Write against the option, if the business idea is of self-employment or wage employment.</td><td>2</td></tr>
</table>

	(a) Cooking in a restaurant (b) Owning a clothing business (c) Having a dosa selling stall (d) Working for someone Ans) a) Waged Employee b) Self Employed c) Self-employed d) Waged employee	

Society and Environment

Over the years, with economic development, there has been an increase in environmental pollution. For example, with the introduction of high input agriculture, we can grow more food by using fertilizers, pesticides and hybrid crops. But it has ledto soil and environmental degradation. We need to plan the use of resources in a sustainable manner so that we and our future generations can enjoy a good environment.

What is Sustainable Development?

Sustainable development is the development that satisfies the needs of the present without compromising the capacity of future generations, guaranteeing the balance between economic growth, care for the environment and social well-being.

Importance of Sustainable Development

Sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'(World Commission on Environment and Development, 1987

Problems Related to Sustainable Development

Three major problems related to sustainable development are:

(a) **Food:** The amount of rich, fertile land needed to grow crops, such as wheat, rice, etc., is becoming less as we are using up more and more land for other purposes. Soil nutrients are also getting depleted and lots of chemicals are spoiling the soil due to use of chemical fertilizers.

(b) Water: We use fresh water from rivers and ponds for drinking and cleaning but dump garbage into them. The rivers and ponds are getting polluted. This way after several years, we will have no clean water for our use.

(c) Fuel: We are using a lot of wood from trees as fuels and for construction of homes and furniture. As more and more trees are being cut, it is affecting the climate of the place. Extreme weather conditions, such as floods, extreme cold or heat, are seen inmany places, which affect the people living there.

Sustainable development includes

- reducing excessive use of resources and enhancing resource conservation;
- recycling and reuse of waste materials;
- scientific management of renewable resources, especially bio-resources;
- planting more trees; green grassy patches and trees to be interspersed betweenconcrete buildings;
- using more environment friendly material or biodegradable material and
- use of technologies, which are environmentally friendly and based on efficient use ofresources.

Sustainable Development Goals

The Sustainable Development Goals (SDGs) are a universal call of action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity. The Sustainable Development Goals (SDGs) were launched at **the United**

Fig. 5.1 Sustainable Development Goals

Nations Sustainable Development Summit in New York in September 2015, forming the 2030Agenda for Sustainable Development. It has set targets that the countries have to should work towards and achieve by 2030. The 17 SDGs have been made with the aim to take care of important issues facing businesses, governments and society. Some of these issues are poverty, gender equality, water use, energy, climate change and biodiversity. Countries are now making policies and regulations that will promote sustainable systems needed in all economic sectors to provide a secure, affordable and sustainable economy.

Our Role in Sustainable

Sustainable development can actually happen only when each one of us works towards it. We have to become responsible environment citizens who can protect the environment through our own efforts. Here are some basic ways in which people canhelp towards Sustainable Development Goals.

Quality Education

Education is the most important factors for sustainable development. Children who have gone to school will be able to do jobs so that they can take care of themselves and their families. Education helps us become aware of our role as a responsible citizen. We should

1. use the facilities present in our areas.
2. take our friends to school.
3. help friends' study.
4. Stop friends from dropping out of school.

Clean Water and Sanitation

We must make efforts to make India free of open defecation by building toilets and creating awareness

towards sanitation.

Affordable and Clean Energy

Using solar power i.e., power generated using the sun does not cause pollution as it does not require burning of non-renewable fuels, such as coal. We are making effortsto increase the solar power generation so that our electricity needs are met and at thesame time we do not pollute the environment

Decent Work and Economic Growth

We can

(a) study and find good jobs to take care of ourselves and our families.

(b) work hard and contribute to society.

(c) learn and develop skills so that we get add value in our community.

Reduced Inequalities

To reduce inequalities, we can

1. be helpful to one another.
2. be friendly with everyone.
3. include everyone while working or playing.
4. help others by including everyone whether they are small or big, girl or boy, belongto any class or caste.

Sustainable Cities and Communities

Creating Sustainable Cities

1. Save energy by switching off lights and fans when not in use.
2. Use natural light as much as possible.
3. Use energy-efficient lights (LED bulbs) and appliances.

Responsible Consumers and Producers

We can become responsible about our own environment by

1. reusing paper, glass, plastic, water, etc.
2. taking cloth bags to market carrying fruits and vegetables.
3. donate things we do not use such as clothes, books, furniture, food, etc.

4. Buy and eat seasonal fruits and vegetables from local growers.
5. Repair leaking taps and pipes to avoid wasting water.
6. Sort and treat garbage before disposing.

Protect Life Below Water

Tons of plastic is found in the seas, which is killing marine life. Protecting marine life,saving our oceans from pollution is necessary to preserve the marine life.

Protect Life on Land

Cutting of trees is leading to soil erosion and making land dry and unusable for cultivation. Planting more tree to replace the ones that we have cut is an important step towards sustainable development.

	ONE MARK QUESTIONS	
1.	Which of the following is/are the result of exploiting our Nature? a. Scarcity of clean water to drink. b. Scarcity of pure air to breathe c. Depletion of ozone layer d. *All of the above*	1
2.	Solution to these global problems like scarcity of clean water to drink, scarcity of pure air to breathe, scarcity of unadulterated food, rising issue of global warming is _____ a. Stop using these resources. b. *Sustainability* c. to make people aware d. None of the above	1
3.	____ is the development that satisfies the needs of the present without compromising the capacity of future generations. a. Overall development b. Economic development c. *Sustainable development* d. None of the above	1
4.	The aim of Sustainable development is a. to inculcate the value of self-resistance amongst the people b. to save natural resources for everyone c. to utilize judiciously and ensure its availability for future generations d. *All of these*	1
5.	Which of the following are common Sustainable Practices? a. Reusing of Waste Water b. Conserving Rain Water c. Segregating waste at source d. *All of the above*	1
6.	Which of the following will help to protect our environment? a. Solar Power Plants b. Waste Water Treatment Plants c. Electric Vehicles d. *All of the above*	1
7.	Which of the following is not included in Sustainable development? a. Green grassy patches and trees to be interspersed between concrete buildings b. Use of technologies, which are environmentally friendly c. *Excessive use of resources and decreasing resource conservation* d. None of the above.	1
8.	SDGs stands for _____ a. *Sustainable Development Goals* b. Sustainable Development Goal seeker	1

	c. Sustainable Developmental Goals d. None of the above	
9.	There are _____ SDGs a. 13 b. *17* c. 12 d. 15	1
10.	In Organic Farming, farmers use _____ a. Chemical Fertilizers b. Pesticides c. Chemical Spray d. *None of the above*	1
11.	Which of the following activities help to conserve the environment? a. Organic Farming b. Vermi-Composting c. Rainwater harvesting d. All of the above	1
12.	Choose the option which is not a sustainable development goal according to United Nations. a. Clean Water and Sanitation b. Gender Equality c. *Population* d. Reduced Inequalities	1
13.	Sustainable Development is the responsibility of _____. a. a person b. a city c. a nation d. *the world*	1
14.	Problems Related to Sustainable Development are _____ . a. Large population b. Poverty c. Lack of Awareness d. *All of the above*	1
15.	Choose the option which defines sustainable development. a. Taking care of future generations. b. Taking care of only ourselves. c. *Taking care of ourselves and the future generations.* d. None of the above	1

	TWO MARKS QUESTIONS	
1.	What is the meaning of sustainable development?	2
2.	List some ways in which we can use resources sensibly	2
3.	Mention two major advantages gained by using ‘Kulhads’	2
4.	Explain the importance of education towards sustainable development.	2
5.	Why do you think the United Nations has made the 17 Sustainable Development Goals?	2
6.	Discuss briefly about any two problems related to Sustainable Development	2
7.	By what are the people of Charanka benefited?	2
8.	How can we become responsible about our own environment?	2
9	Explain Organic Farming.	2
10	What innovation did Mr Avasth Hedge make? Explain	2
11	What do you understand by the term sustainable agriculture?	2
12	What led to Environment Pollution?	2
13	“With increasing population and income, the consumption of goods is increasing day by day.” - Comment	2
14	What are the core skills required by a person who wants to contribute towards environment?	2
15	How can we achieve Sustainable development?	2

Answer Key

Q.	Answer the given questions on Green Skills (2 Marks each)	
1.	Sustainable development is the development that satisfies the needs of the present without compromising the capacity of future generations, guaranteeing the balance between economic growth, care for the environment and social well-being	2
2.	1. reusing paper, glass, plastic, water, etc. 2. taking cloth bags to market carrying fruits and vegetables. 3. donate things we do not use such as clothes, books, furniture, food, etc. 4. Buy and eat seasonal fruits and vegetables from local growers.	2
3.	1. reduce cutting of tree for making paper cups. 2. job creation for potters, which contributes to economy.	2
4.	Education is the most important factors for sustainable development. Children who have gone to school will be able to do jobs so that they can take care of themselves and their families.	2
5.	The 17 SDGs have been made with the aim to take care of important issues facing businesses, governments and society. Some of these issues are poverty, gender equality, water use, energy, climate change and biodiversity.	2
6.	(a) Food: The amount of rich, fertile land needed to grow crops, such as wheat, rice, etc., is becoming less as we are using up more and more land for other purposes. (b) Water: We use fresh water from rivers and ponds for drinking and cleaning but dump garbage into them. The rivers and ponds are getting polluted. (c) Fuel: We are using a lot of wood from trees as fuels and for construction of homes and furniture. As more and more trees are being cut, it is affecting the climate of the place. (Any two issue)	2
7.	Large scale production of solar power in Charanka has reduced the dependence on non-renewable fossil fuels in Gujarat. The people of Charanka have benefited as they have a good source of income and this will also help future generations in the next 40–50 years to come	2
8.	We can become responsible about our own environment by 1. reusing paper, glass, plastic, water, etc. 2. taking cloth bags to market carrying fruits and vegetables. 3. donate things we do not use such as clothes, books, furniture, food, etc. 4. Buy and eat seasonal fruits and vegetables from local growers. 5. Repair leaking taps and pipes to avoid wasting water.	2

	6. Sort and treat garbage before disposing (any two valid points)	
9	Organic farming is where farmers do not use chemical pesticides and fertilisers to increase their production. They use organic and natural fertilisers, such as cow dung to help in growing crops. This helps in better quality chemical free crops while at the same time maintaining the soil quality for future use.	2
10	When plastics were banned by the municipal corporation of Mangalore, an innovator and entrepreneur Mr Avasth Hedge found an eco-friendly alternative. He made a 100 per cent bio-degradable bag which can dissolve in hot water and decompose in natural environment.	2
11	Sustainable agriculture consists of environment friendly methods of farming that allow the production of agricultural crops or livestock without damage to human or natural systems. It also involves preventing the use of chemicals so as to avoid adverse effects to soil, water and biodiversity.	2
12	With economic development, there has been an increase in environmental pollution. For example, with the introduction of high input agriculture, we can grow more food by using fertilisers, pesticides and hybrid crops. But it has led to soil and environmental degradation.	2
13	"With increasing population and income, the consumption of goods is increasing day by day." This has led to increase in production and utilisation of natural resources, which are required for producing goods. Society must thus change its development strategy to a new form where development will not destroy the environment.	2
14	The core skills required by a person who wants to contribute towards environment include environmental awareness and willingness to learn about sustainable development. If one is responsible about life, then they will do their best at home, in school and at their workplace to help the environment and the people around them.	2
15	Sustainable development can actually happen only when each one of us works towards it. We have to become responsible environment citizens who can protect the environment through our own efforts	2

PART-B: SUBJECT SPECIFIC SKILLS

UNIT-1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Intelligence:

Intelligence is an ability to understand information, and to retain it as knowledge to be applied in a particular situation or context.

Artificial Intelligence:

Refers to any technique that enables computers to mimic human intelligence. It gives the ability to machines to recognize a human's face; to move and manipulate objects; to understand the voice commands by humans, and also do other tasks. The AI-enabled machines think algorithmically and execute what they have been asked for intelligently.

Artificial Intelligence vs Natural Intelligence

Artificial Intelligence	Natural Intelligence
Found in Machines	Found in Humans
AI Machines are Built/Designed with Data and Algorithms	Built based on observation, Learning and etc.
Machines with AI Can perform large complex calculations	Humans have limitation to compute.

What is NOT AI:

It is very common for us to misunderstand any other technology as AI.

The machine/device which is trained with data and makes decision or prediction based on data and algorithms are considered as AI. Below are some examples which are not AI.

An Automatic Washing machine operates based on instructions provided by the user.

Air Conditioner is operated by humans using remote. Humans need to set the timer and temperature based on requirement. Air Conditioner can be turned on/off from a different location. Still it needs human to operate.

Smart TV uses different applications and technologies in it, which make ease of using. These also need humans to operate.

Self-Driving cars which are operated based on remote control, sensor based does not make them as AI.

Applications of AI

A. AI in E-Commerce websites
   (Examples: Amazon, Flipkart, Myntra and etc.)
B. AI in Virtual Assistants (Examples: Google Assistant, Alexa, Siri and etc)
C. AI in Self Driving Cars (Examples: Tesla, XUV 700 and etc)
D. AI in Health care (Examples: Medical Image Analysis, AI Enabled Medical Diagnosis and etc.)
E. AI in Gaming (Examples: Cricket, FIFA, Racing Games and etc.)

AI Bias:

AI model is trained with huge set of data. This data is called training data. If this data is biased, the output of the AI model will also be biased.

AI Bias is an irregularity in the outcome of a model/Algorithm due to data collected is unbalanced and based on wrong assumptions.

OBJECTIVE TYPE QUESTIONS 1 MARK

1. Chatbots and smart bots are related to _____ domain of AI.
a. Data Science
b. Machine Learning
c. Computer Vision
d. Natural Language Processing

2. In Weather forecasting system, to predict the temperature, rainfall and etc. The type of technology used is _____.
a. Computer Vision
b. Interpersonal Intelligence
c. Natural Language Processing
d. Artificial Intelligence

3. An important technology used for facial recognition in phones is _____ of AI.

a. Data Science
b. Machine Learning
c. Computer Vision
d. Natural Language Processing

4. What is/are the reason(s) for AI Bias in data?
a. Improper assumptions
b. Uneven data collection
c. No testing on Data
d. All the above

5. Which of the following is Not AI?
i. Air Conditioner
ii. Automatic Washing Machine
iii. Self-Driving Car
iv. Smart TV
a. i, ii & iii
b. i & ii
c. i, ii & iv
d. iii & iv

6. Aaron is facing issue in his internet connectivity at home. He called customer care service, A virtual assistant took his complaint and replied with an acknowledgement number. What is the AI technology used by Internet service provider?
a. Data Science
b. Machine Learning
c. Computer Vision
d. Natural Language Processing

7. Which of the following statement is incorrect?
a. Email Filtering is an application of NLP
b. Price comparison websites are applications of Data Science
c. Virtual Assistants are not applications of NLP
d. Self-driving cars are applications of Computer Vision.

8. What is important to make a Good AI Machine?
a. Algorithm
b. Data
c. Test cases
d. All the above.

9. Deep Face technology, which creates a person real in virtual world is based on

_____.

a. Computer Vision
b. Computer Aided Design
c. Natural Language Processing
d. Data Science

10. Results based on discriminatory assumptions made while developing algorithm by the developer is called as _____.

a. AI Ethics
b. AI Bias
c. Test Data
d. Training Data

11. Rajan is an employee in MNC, whenever he feels stressed, he would like to spend some time with friends, listens to music and relieves his stress, He possess _____ Intelligence.

a. Kinesthetic
b. Spatial
c. Inter Personal
d. Intra Personal

12. Which of the following is invalid with regard to Data Privacy?

a. Allow all permission while installing apps in smart phones can leak data.
b. Denying all permission will allow to install app in smart phone.
c. Use apps which don't make permissions compulsory.
d. Use apps Reliable and Authentic.

13. In a company a person knows the income and expenditure of the company and calculates Salary based on Leaves is said to have _____ intelligence.

a. Spatial
b. Musical
c. Mathematical
d. Interpersonal

14. An organization is using a AI enabled Security surveillance system. Surya works as a Security guard in the Organization. Due to usage of AI enabled security system he has a feeling that he may not be needed in the near future. What is this situation?

a. Data Privacy b. AI Bias c. AI Access d. AI is creating Unemployment

15. AI Machines are composed of

a. Software

b. Hardware
c. Machine/Device
d. Software. Hardware & Machine

SHORT ANSWER TYPE QUESTIONS 2 MARKS

1. Describe how Machines are made Smart/Intelligent?
2. How Deep Learning Machines work?
3. What is AI Bias?
4. Define AI Ethics.
5. Write a difference between Interpersonal vs Intrapersonal
6. Give Examples of machines that are smart but not AI.
7. What is AI Access?
8. Write Examples of Features or applications used in Smart Phone that uses AI.
9. How do you understand whether a machine/application is AI based or not? Explain with an example.
10. Define Intelligence.

LONG ANSWER TYPE QUESTIONS 4 MARKS

1. What are the different types of Intelligences.
2. Write the Applications of AI
3. What are the different domains of AI
4. Explain the AI Categories/branches?

MARKING SCHEME

OBJECTIVE TYPE QUESTIONS 1 MARK

1. (d) Natural Language Processing
2. (d) Artificial Intelligence
3. (c) Computer Vision
4. (d) All the above
5. (c) i, ii & iv
6. (d) Natural Language Processing
7. (c) Virtual Assistants are not applications of NLP
8. (d) All the above

9. (a) Computer Vision

10. (b) AI Bias

11. (d) Intra Personal

12. (b) Denying all permission will allow to install app in smart phone.

13. (c) Mathematical

14. (d) AI is creating Unemployment

15. (d) Software. Hardware & Machine

SHORT ANSWER TYPE QUESTIONS 2 MARKS

1. Describe how Machines are made Smart/Intelligent?

   Answer:

   Machines are trained using data and algorithms. Once the machines give the expected result/output these are tested repeatedly. These machines are updated based on data, past results. Hence Machine can analyze data and can take decisions intelligently.

2. How Deep Learning Machines work?

   Answer:

   Deep Learning is a subset of Machine Learning. Deep Learning enables machines to train with huge amount of data which helps it in training itself around the data. These machines are capable to develop algorithms for themselves.

3. What is AI Bias?

   AI Bias is an irregularity in the outcome of a model/Algorithm due to data collected is unbalanced and based on wrong assumptions.

4. Define AI Ethics.

   AI Ethics are Set of principles to be followed while developing an AI model/machine/algorithm.

5. Write a difference between Interpersonal vs Intrapersonal Intelligence.

   Intra-personal Intelligence is related to a person's ability to understand about himself/herself, feelings and thoughts.

   Interpersonal Intelligence is related to a person's ability to understand and communicate effectively with others.

6. Give Examples of machines that are smart but not AI.

   Answer:

   Air Conditioner,

   Automatic Washing Machine,

   IOT Devices,

   Smart TV and etc.

7. What is AI Access?

The people who can afford AI enabled devices make the most of it while others who cannot are left behind. Because of this, a gap has emerged between these two classes of people and it gets widened with the rapid advancement of technology.

8. Write Examples of Features or applications used in Smart Phone that uses AI.

Answer:

Face Lock, Google Maps, Google Assistant,

E-Commerce apps, Social Media apps,

Audio/Video Streaming Platforms and etc.

9. How do you understand whether a machine/application is AI based or not? Explain with an example.

Answer:

Any machine/application that is trained with data and can make decisions/predictions on its own can be termed as AI.

Example: The bot or automation machine is not trained with any data is not an AI. while a chatbot that understands and processes human language is an AI.

10. Define Intelligence.

Intelligence is an ability to understand information, and to retain it as knowledge to be applied in a particular situation or context.

LONG ANSWER TYPE QUESTIONS 4 MARKS

1. What are the different types of Intelligences

A. Mathematical Logical Reasoning:

A person's ability to regulate, measure, and understand numerical symbols, abstraction and logic.

B. Linguistic Intelligence

It is a person's ability of Language processing skills both in terms of understanding or implementation in writing or verbally. Examples: Poets, Journalists and etc are said to have this intelligence.

C. Spatial Visual Intelligence

It is defined as the ability to perceive the visual world and the relationship of one object to another. Examples: Architects, Sculptures and etc are said to have this form of intelligence

D. Kinaesthetic Intelligence

It is an ability that is related to how a person uses his limbs in a skilled manner. Examples: Athletes, dancers and etc are said to have this form of intelligence.

E. Musical Intelligence

This intelligence is about a person's ability to recognize and create sounds, rhythms and sound patterns.

Examples: Musicians, Singers, Instrument Players and etc are said to have this form of intelligence

F. Intrapersonal Intelligence

It is a person ability to know his thoughts, feelings, weakness and strength.

G. Existential Intelligence

This intelligence is related to religious and spiritual awareness about life, our existence, purpose, meaning of life and etc.

H. Naturalist Intelligence

This intelligence is related to the ability to process information around us. To know about living things, non-living things and etc.

I. Interpersonal intelligence

It is the ability to communicate with others by understanding their feelings.

2. Applications of AI

F. AI in E-Commerce websites (Examples: Amazon, Flipkart, Myntra and etc.)
G. AI in Virtual Assistants (Examples: Google Assistant, Alexa, Siri and etc.)
H. AI in Self Driving Cars (Examples: Tesla, XUV 700 and etc.)
I. AI in Health care (Examples: Medical Image Analysis, AI Enabled Medical Diagnosis and etc.)
J. AI in Gaming (Examples: Cricket, FIFA, Racing Games and etc.)

3. Domains of AI

The Three Domain of AI:

A. Data Science: -

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

The information extracted through data science can be used to decide about it.

Applications:

Price Comparison Websites, Targeted Advertising, Stock Market Analysis and etc

B. Computer Vision: -

Computer Vision is a domain of AI that depicts the capability of a machine to get and analyse visual information and afterwards predict some decisions about it.

The entire process involves image acquiring, screening, analysing, identifying and extracting information.

This makes devices visually enabled and gives the capability to understand the

visual information.

Applications:

Self-Driving Cars, Face lock in smart phones, Filters in images and etc.

C. Natural Language Processing: -

Natural Language Processing is a domain of AI that deals with the interaction of computers and humans using the natural language.

Natural language refers to language that is spoken and written by people.

Natural Language Processing (NLP) attempts to extract information from the spoken and written words to understand its meaning.

Applications: -

Virtual Assistants, E-Mail Filters, Speech to Text conversion and etc.

4. AI Categories:

Artificial Intelligence:

Refers to any technique that enables computers to mimic human intelligence. It gives the ability to machines to recognize a human's face; to move and manipulate objects; to understand the voice commands by humans, and also do other tasks. The AI-enabled machines think algorithmically and execute what they have been asked for intelligently.

Machine Learning (ML)

It is a subset of Artificial Intelligence which enables machines to improve at tasks with experience (data). The intention of Machine Learning is to enable machines to learn by themselves using the provided data and make accurate Predictions/ Decisions.

Deep Learning (DL)

It enables software to train itself to perform tasks with vast amounts of data. In Deep Learning, the machine is trained with huge amounts of data which helps it in training itself around the data. Such machines are intelligent enough to develop algorithms for themselves.

UNIT-2: AI PROJECT CYCLE

What is an AI Project Cycle?

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

Let us take some daily examples as projects, requiring steps to solve theproblem. Creating a birthday card.

1. Checking the factors like budget, etc which will help us decide the next steps andunderstanding the Project.
2. Acquiring data from different sources like online, with friends etc for Designs andideas.
3. Making a list of the gathered data.
4. Creating or modelling a card on the basis of the data collected.
5. Showing it to Parents or cousins to let them check it or evaluate it.

Components of AI Project Cycle?

Components of the project cycle are the steps that contribute to completing the Project.The Components of AI Project Cycle are:

-

- **Problem Scoping** - Understanding the problem
- **Data Acquisition** - Collecting accurate and reliable data
- **Data Exploration** - Arranging the data uniformly
- **Modelling** - Creating Models from the data
- **Evaluation** - Evaluating the project

1. Problem Scoping

Problem Scoping refers to understanding a problem, finding out various factors which affect the problem, define the goal or aim of

the project.

Sustainable Development Goals Sustainable Development: To Develop for thepresent without exploiting the resources of the future.

- 17 goals announced by United Nations.
- Aim to achieve them by 2030.
- Pledge taken by all the member nations of the UN.

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet, and ensure that all people enjoy peace and prosperity.

4 W's of Problem Scoping

Problem Statement Template

The 4W's of Problem Scoping are Who, What, Where, and Why.

This W's helps in identifying and understanding the problem in a better and efficient manner.

- Who - "Who" part helps us in comprehending and categorizing who all are affected directly and indirectly with the problem and who are called the Stake Holders.
- **What** - "What" part helps us in understanding and identifying the nature of the problem and under this block, you also gather evidence to prove that the problem you have selected exists.
- **Where** - "Where" does the problem arise, situation, context, and location?
- **Why** - "Why" is the given problem worth solving?

Problem Statement Template

The Problem Statement Template helps us to summarize all the key points into one single template. So that in the future, whenever there is a need to look back at the basis of the problem, we can take a look at the

Problem Statement Template and understand its key elements of it.

Have a look at Problem Statement Template.

The	Stakeholder	Who
Have a problem	Issue/Problem	What
When/While	Context/Situation/Location	Where
Ideal Solution	How the solution will help the stakeholders	Why

2. Data Acquisition

The process of collecting accurate and reliable data to work with. Two types of Data Sets

Base	**Training set**	**Testing set**
Use	Used for Training the model	Used for Testing the model after it is trained
Size	Is allot bigger than testing data and constitutes about 70% to 80%	It is smaller than Training set and constitutes about 20% to 30%

Data Features

- Refer to the type of data you want to collect.
- E.g.: Salary amount, increment percentage, increment period, bonus etc.

Big data

- It includes data with sizes that exceed the capacity of traditional software to process within an acceptable time and value.
- The main focus is on unstructured type of data

- Observations
  - When we observe something carefully, we get some information
  - For ex: Scientists Observe creatures to study them.
  - Observations are a time-consuming data source.
- Surveys
  - The survey is a method of gathering specific information from a sample of people.
  - Example, a census survey for analysing the population

Data Exploration

In this stage of project cycle, we try to interpret some useful information out of the data we have acquired. For this purpose, we need to explore the data and try to put it uniformly for a better understanding. This stage deals with validating or verification of the collected data and to analyze that:

- The data is according to the specifications decided.
- The data is free from errors.

- Web Scraping
  - Web Scraping means collecting data from web using some technologies.
  - We use it for monitoring prices, news and etc.
  - Example: Web Scrapping using beautiful soup in python.
- Sensors
  - Sensors are very important but very simple to understand.
  - Sensors are the part of IoT (Internet of things)
  - Sensors collect the physical data and detect the changes.

- Cameras
  - Camera captures the visual information and then that information which is called image is used as a source of data.
  - Cameras are used to capture raw visual data.
- API
  - Application Programming interface.
  - API is a messenger which takes requests and tells the system about requests and gives the response.
  - Ex: Twitter API, Google Search API

➢ The data is meeting our needs This stage is divided into 2 sub stages.

1) Data Cleaning
2) Data Visualization.

1) Data Cleaning

Data cleaning helps in getting rid of commonly found errors and mistakes in a data set. These are the 3 commonly found errors in data.

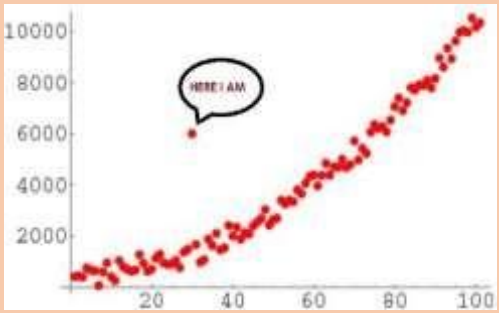
1) Outliers: Data points existing out of the range.
2) Missing data: Data points missing at certain places.
3) Erroneous data: Incorrect data points.

Outliers

An outlier is a data point in a dataset that is distantfrom all other observations.

or

An outlier is something that behaves differently fromthe combination/ collection of the data.



Missing Data

What do these NaN valuesindicate? They are the missing values in the data set.

We can handle them in two ways:

1. By eliminating the rows of missing values. (Generally, not recommended as it might reduce the data set to some extent leading to less data to be trained)

```
data1=pd.read_csv("airquality.csv")
```

```
data1
```

	Ozone	Solar.R	Wind	Temp	Month	Day
0	41.0	190.0	7.4	67	5	1
1	36.0	118.0	8.0	72	5	2
2	12.0	149.0	12.6	74	5	3
3	18.0	313.0	11.5	62	5	4
4	NaN	NaN	14.3	56	5	5
5	28.0	NaN	14.9	66	5	6

2. By Using an Imputer to find the best possible substituteto replace missing values.

3. Erroneous Data:

Erroneous data is test data that falls outside of what is acceptable and should be rejected bythe system. **Student Name**	**Class**
RIYA GEORGE	X A
JOSHUA SAM	X A
APARNA BINU	X A
SIDHARDH V R	X A
NITHILA M	57
ATHULYA M S	X A
ANUJA MS	X B
KEERTHI KRISHNANATH	X B

1) Data Visualization

Why we need to explore data through visualization?

1) We want to quickly get a sense of the trends, relationships, and

patterns contained within the data.

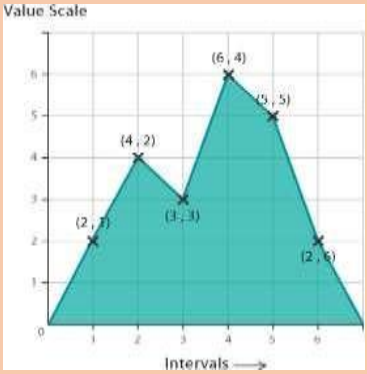
2) It helps us define strategy for which model to use at a later stage.

Visual representation is easier to understand and communicate to others. Example

Excel Table

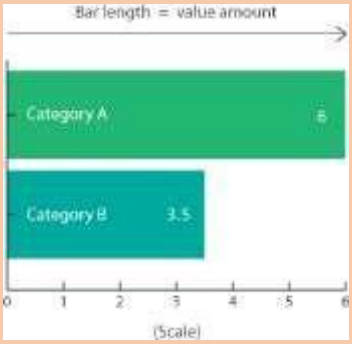
Facility Name	Year	Salary_Cost	Hourly_Cost
Bracebridge	Y2017	$ 208,137	$ 38,935
Brantford	Y2017	$ 125,479	$ 41,096
Bronte	Y2017	$ 156,192	$ 75,196
Burlington	Y2017	$ 290,521	$ 55,608
Gravenhurst	Y2017	$ 202,055	$ 50,642
London	Y2017	$ 209,945	$ 45,128
Pickering	Y2017	$ 175,699	$ 38,766
Port Perry	Y2017	$ 246,932	$ 71,848
Sault Ste. Marie	Y2017	$ 293,808	$ 50,097
Sudbury	Y2017	$ 123,699	$ 44,640

3: Data Visualization Techniques



1. **Area Graphs**

Area Graphs are Line Graphs but with the area below the line filled in with a certain colour or texture. Like Line Graphs, Area Graphs are used to display the development of quantitative values over an interval or time period. They are mostcommonly used to show trends, rather than convey specific values.

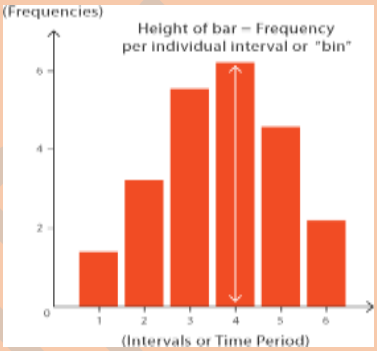


2. **Bar Charts**

The classic Bar Chart uses either horizontal or vertical bars (column chart) to show discrete, numerical comparison across categories. Bars Charts are distinguished from Histograms, as they do not display continuous developments over an interval. Bar Chart's

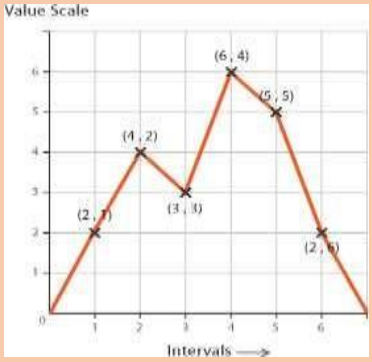
discrete data is categorical data and therefore answers the question of "how many?" in each category.

3. Histogram



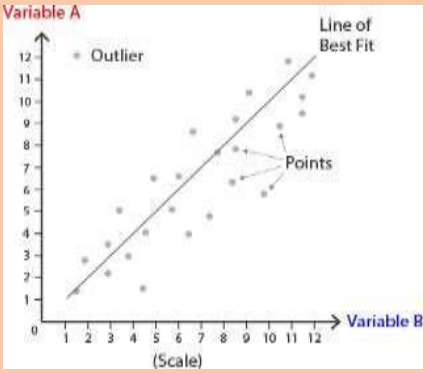
A Histogram visualizes the distribution of data over a continuous interval or certain time period. Each bar in a histogram represents the tabulated frequency at each interval/bin. Histograms help give an estimate as to where values are concentrated, what the extremes are and whether there are any gaps or unusual values.

4. Line Graphs



Line Graphs are used to display quantitative values over a continuous interval or time period. A Line Graph is most frequently used to show trends and analyze how the datahas changed over time. Line Graphs are drawn by first plotting data points on a Cartesian coordinate grid, then connecting a line between all of these points.

Typically, the y-axis has a quantitative value, while the x-axis is a timescale or a sequence of intervals. Negative values can be displayed below the x-axis.

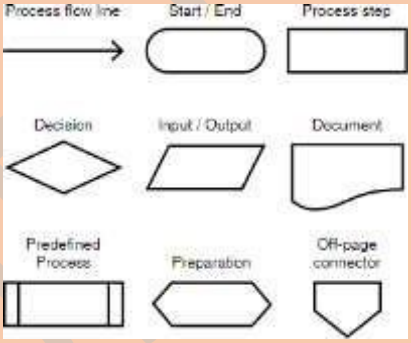


5. Scatterplots

A scatterplot is a type of data display that shows the relationship between two numerical variables. Each member of the

dataset gets plotted as a point whose (x, y) coordinates relates to its values for the two variables.

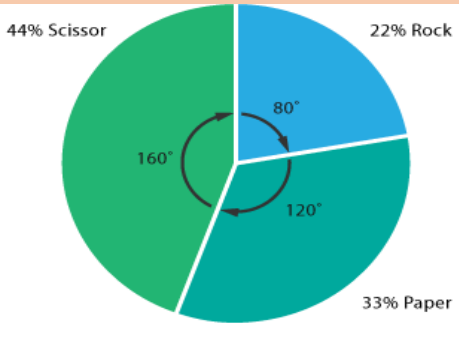
6. Flow Charts



This type of diagram is used to show the sequential steps of a process. Flow Charts map out a process using a series of connected symbols, which makes process easy to understand and aids in its communication to other people. Flow Charts are useful for explaining how a complex and/or abstract procedure, system, concept or algorithm work. Drawing a Flow Chart can also help in planning an developing an existing one relationship or correlation between the two variables exists.

7. Pie Charts

Pie Charts help show proportions and percentages between categories, by dividing a circle into proportional segments. Each arc length represents a proportion of each category, while the full circle represents the total sum of all the data, equal to 100%. Pie Charts are ideal forgiving the reader a quick idea of the proportional distribution of the data.



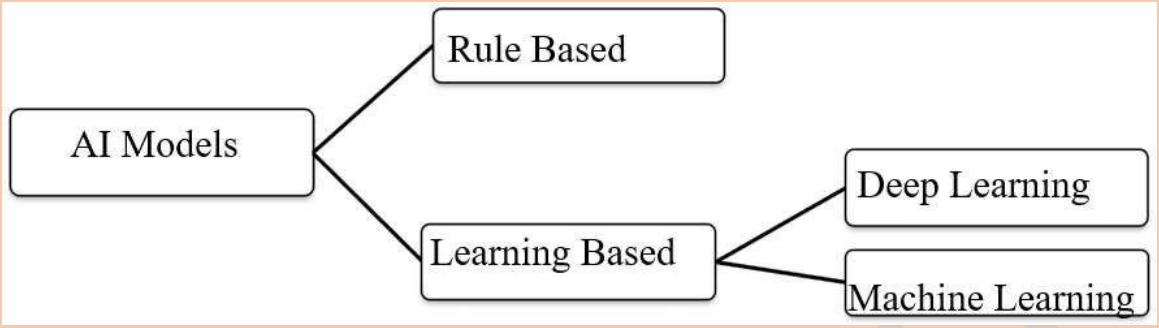
Data			
Rock	Paper	Scissor	TOTAL
2	3	4	9
To calculate percentages			
2/9=22%	3/9=33%	4/9=44%	100%
Degrees for each "pie slice"			
(2/9) x 360 = 80°	(3/9) x 360 = 120°	(4/9) x 360 = 160°	360°

4. Modelling

It's the fourth stage of AI project cycle. In previous stage, i.e. graphical representation makes the data understandable for humans as we can discover trends and patterns out of it. But when it comes to machines accessing and analyzing data, it needs the data in the most basic form of numbers (which is binary – 0s and 1s) and when it comes to discovering patterns and trends in data, the machine goes in for mathematical representations of the same.

The ability to mathematically describe the relationship between parameters isthe heart of every AI model.

Generally, AI models can be classified as follows:



Rule Based Approach

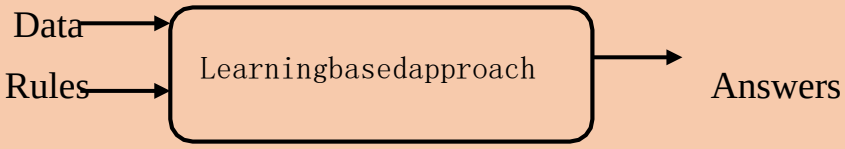
In this approach, the rules are defined by the developer. The machine follows the rules or instructions mentioned by the developer and performs its task accordingly. So, it's a static model. i.e. the machine once trained, does not take into consideration any changes made inthe original training dataset

Thus, machine learning gets introduced as an extension to this as in that case, the machine adapts to change in data and rules and follows the updated path only, while a rule-based model does what it has been taught once.

Learning Based Approach

It's a type of AI modelling where the machine learns by itself. Under the Learning Based approach, the AI model gets trained on the data fed to it and then is able to design a model which is adaptive to the change in data. That is, if the model is trained with X type of data and the machine designs the algorithm around it, the model would modify itself according to the changes which occur in the data so that all the

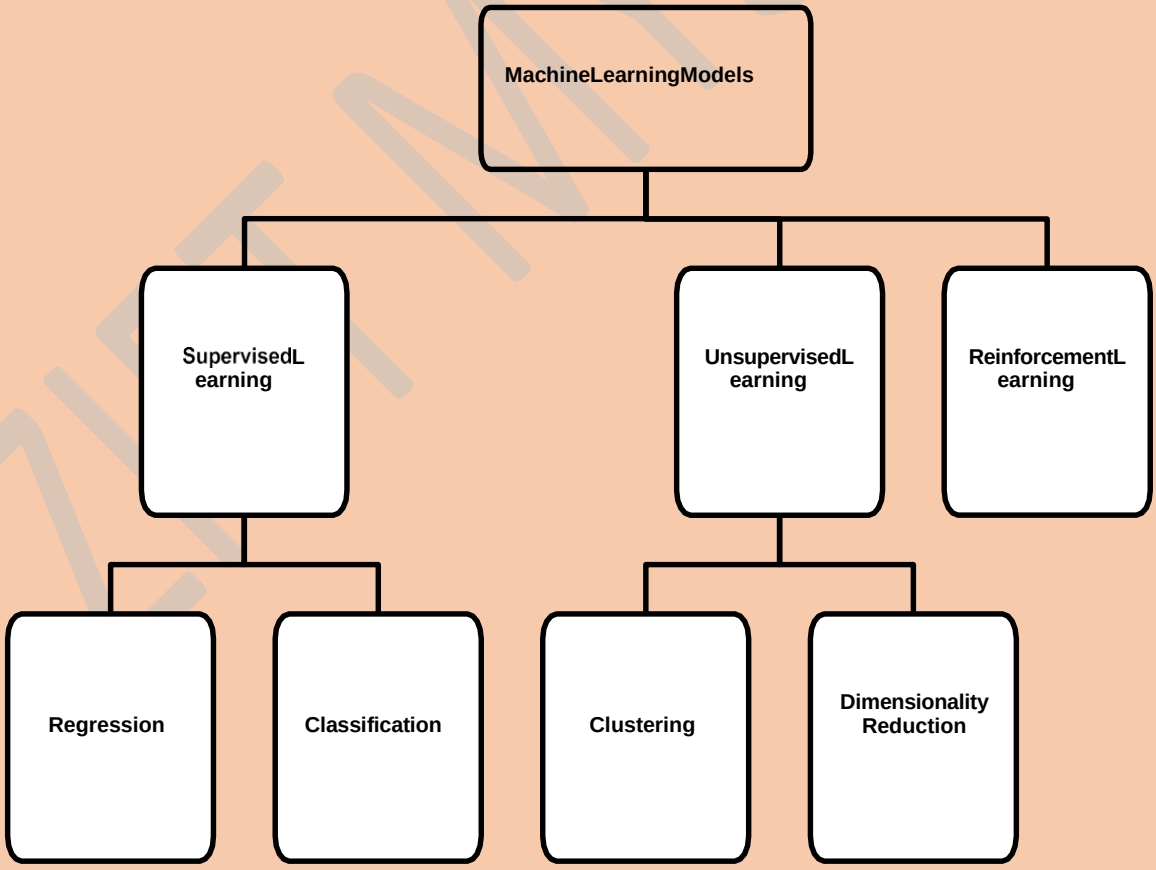
exceptions are handled in this case.



After training, the machine is now fed with testing data. Now, the testing data might not havesimilar images as the ones on which the model has been trained. So, the model adapts to the features on which it has been trained and accordingly predicts the output.

In this way, the machine learns by itself by adapting to the new data which is flowing in.This is the machine learning approach which introduces the dynamicity in the model.

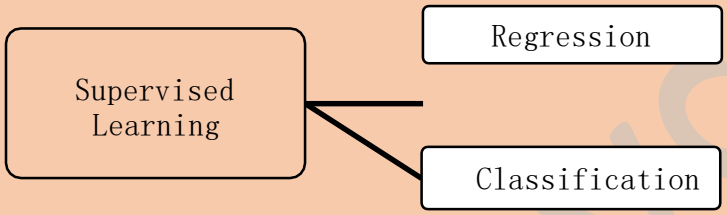
Generally, learning based models can be classified as follows:



I. Supervised Learning

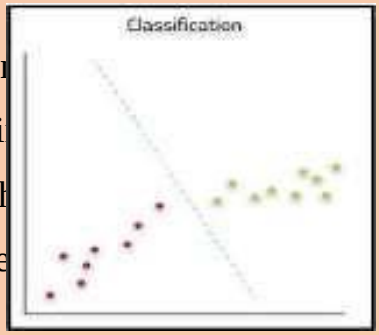
In a supervised learning model, the dataset which is fed to the machine is labelled. In other words, we can say that the dataset is known to the person who is training the machine only then he/she is able to label the data. A label is some information which can be used as a tag for data. For example, students get grades according to the marks they secure in examinations. These grades are labels which categorize the students according totheir marks.

There are two main types of supervised learning models:



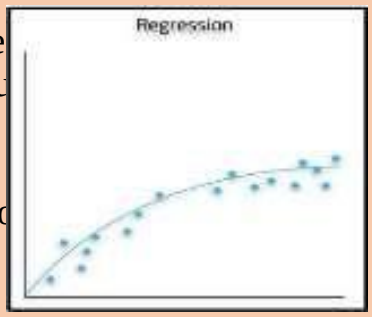
a) Classification

In this model, data is classified according to the labels. For example, in the grading system, studer are classifiedon the basis of the grades they obtai with respect to their marks in the examination. Th model works on discrete dataset which means the data need not be continuous.



b) Regression

This model work on continuous data. For example you wish to predict your next salary, then you wou put in the data of yourprevious salary, any increments, etc., and would train the model. Here, data which has been fed to the machine is continuc



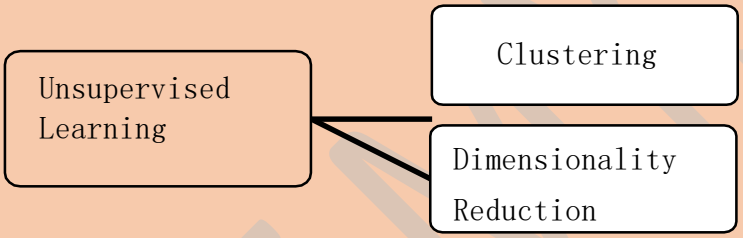
II. Unsupervised Learning

An unsupervised learning model works on unlabeled dataset. This means

that the data which is fed to the machine is random and there is a possibility that the person who is training the model does not have any information regarding it. The unsupervised learning models are used to identify relationships, patterns and trends out of the data which is fed into it. It helps the user in understanding what the data is about and what are the major features identified by the machine in it.

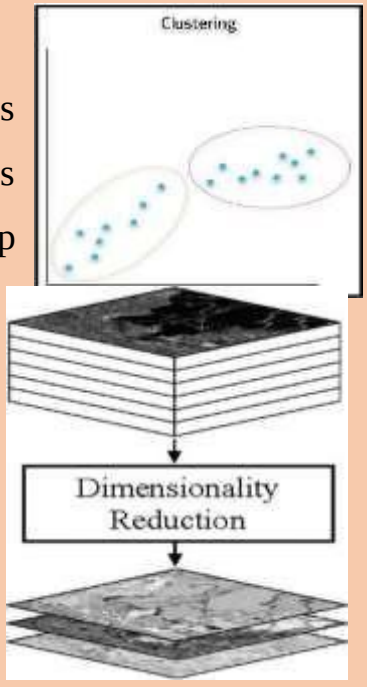
For example, you have a random data of 1000 dog images and you wish to understand some pattern out of it, you would feed this data into the unsupervised learning model and would train the machine on it. After training, the machine would come up with patterns which it was able to identify out of it. The Machine might come up with patterns which are already known to the user like colour or it might even come up with something very unusual like the size of the dogs.

There are two main types of unsupervised learning models:



Clustering

It refers to the unsupervised learning algorithm which can cluster the unknown data according to the patterns or trends identified out of it. The patterns observed might be the ones which are known to the developer or it might even come up with some unique patterns out of it.



a) Dimensionality Reduction

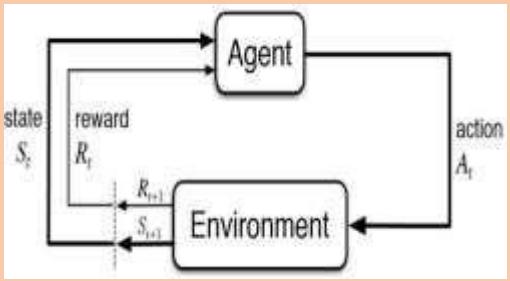
We humans are able to visualize up to 3 Dimensions only but according to a lot of theories and algorithms, there are various entities which exist beyond 3-

Dimensions.

For example, in Natural language Processing, the words are considered to be N-Dimensional entities. Which means that we cannot visualize them as they exist beyond our visualization ability. Hence, to make sense out of it, we need to reduce their dimensions. Here, dimensionality reduction algorithm is used.

III. Reinforcement Learning

It a type of machine learning technique that enables an agent(model) to learn in an interactive environment by trial and error using feedback from its own actions and experiences. Though both supervised and reinforcement learning use mapping between input and output, unlike supervised learning where feedback provided to the agent(model) is correctset of actions for performing a task, reinforcement learning uses rewards and punishment as signals for positive and negative behavior. Reinforcement learningis all about making decisions sequentially.



5. Evaluation

Evaluation is a process of understanding the reliability of any AI model, based on outputs by feeding the test dataset into the model and comparing it with actual answers. i.e.o once a model has been made and trained, it needs to go through proper testing so that one can calculate the efficiency and performance of the model. Hence, the model is tested with the help of Testing

Data (which was separated out of the acquired dataset at Data Acquisition stage.

The efficiency of the model is calculated on the basis of the parameters mentioned below:

1. Accuracy

Accuracy is defined as percentage of the correct predictions out of all the observations.

2. Precision

Precision is defined as the percentage of true positive cases versus all the cases where the prediction is true.

3. Recall

Recall is defined as the fraction of positive cases that are correctly Identified.

4. F1 score

The F1 score is a number between 0 and 1 and is the harmonic mean of precision and r

ONE MARK QUESTIONS

1. The AI Project Cycle is a _____ that a company must follow in order to derive value from an AI project and to solve the problem.
   a. Step-by-step process
   b. Random process
   c. Reverse process
   d. None of the above
2. 2. The stages of the AI project cycle are _____.
   a. Problem Scoping & Data Acquisition
   b. Data Exploration & Modeling
   c. Evaluation
   d. All of the above
3. Fill in the blank: Neural Network is a mesh of multiple _____. (Hidden Layers)
4. Divya was learning neural networks. She understood that there were three layers in a neural network. Help her identify the layer that does processing in the neural network.
   (a) Output layer

(b) Hidden layer

(c) Input layer

(d) Data layer

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

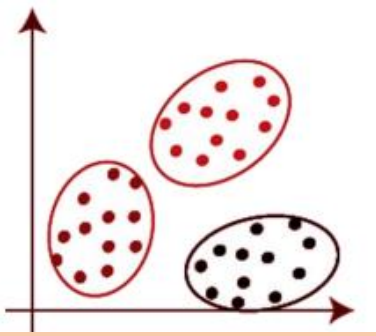
a. Understand why the project was started

b. Define the project's primary objectives

c. Outline the project's work statement.

d. All of the above

6. Identify the algorithm based on the given graph



(a) Dimensionality reduction

(b) Classification

(c) Clustering

(d) Regression

7. Smita is working on a project that involves over a lakh of records. Which of the following should she use to make the best project?

(a) Traditional programming

(b) Manual processing

(c) IoT

(d) Neural networks

8. _____ element helps us to understand and categorize who is directly and indirectly affected by the problem.

a. Who

b. What

c. Where

d. Why

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

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

Choose the correct option:

(a) Both i and ii

(b) Both i and iv

(c) Only I

(d) Only iv

10._____ section aids us in analyzing and recognizing the nature of the problem.
a. Who
b. What
c. Where
d. Why

11. _____ elements help to find where the problem arises.
a. Who
b. What
c. Where
d. Why

12._____refers to why we need to address the problem and what the advantages will be for the stakeholders once the problem is solved.
a. Who
b. What
c. Where
d. Why

13._____ summarizes all of the important points in one place.
a. Problem statement template
b. Problem statement document
c. Problem statement file
d. None of the above

14.The method of collecting correct and dependable data to work with is known as _____.
a. Problem Scoping
b. Data Acquisition
c. Data Exploration
d. Modeling

15.What is data in AI?
a. Facts
b. Instruction
c. Information
d. All of the above

16.Which of the following refers to where among 4Ws canvas?
a. stakeholders b. nature of the problem

c. context/situation/location d. solution or benefits to the stakeholders

17. What are the different types of data _____.
    a. Structured Data
    b. Unstructured Data
    c. Both a) and b)
    d. None of the above
18. If data is easily accessible by humans and program, and easy to read is known as _____.
    a. Structured Data
    b. Unstructured Data
    c. Both a) and b)
    d. None of the above
19. _____ data doesn't follow traditional data models and is difficult to read, store and manage.
    a. Structured Data
    b. Unstructured Data
    c. Both a) and b)
    d. None of the above
20. The dataset is divided in two parts _____.
    a. Machine dataset & Model dataset
    b. Training dataset & Test dataset
    c. Gaolable dataset & local dataset
    d. None of the above
21. _____ is a collection of data in tabular format.
    a. Dataset
    b. Structured Data
    c. Unstructured Data
    d. None of the above
22. A device that detects or measures a physical property is called _____.
    a. Sensor
    b. API
    c. Observation
    d. None of the above
23. An _____ is a software interface that enables the interaction between two apps.
    a. Sensor
    b. API
    c. Observation
    d. None of the above

24. What is a System Map?
    a. Helps to make relation between multiple element
    b. Only one element will be responsible
    c. Indicate the relationship using + or –
    d. Both a) and c)
25. Data analysts utilize data visualization and statistical tools to convey dataset characterizations, such as _____.
    a. size
    b. amount
    c. accuracy
    d. All of the above
26. Data exploration is a technique used to visualize data in the form of statistical methods or using graphs.
    a. Statistical methods
    b. Graphical methods
    c. Both a) and b)
    d. None of the above
27. Data Exploration helps you gain a better understanding of a _____.
    a. *Dataset*
    b. Database
    c. accuracy
    d. None of the above
28. _____helps to represent graphical data that use symbols to convey a story and help people understand large volumes of information.
    a. Dataset
    b. *Data visualization*
    c. Data Exploration
    d. None of the above
29. A machine that work and react like human is known as _____.
    a. Artificial Intelligence
    b. Machine Learning
    c. Deep Learning
    d. None of the above
30. Machine have abilities to learn from the experience or data.
    a. Artificial Intelligence
    b. Machine Learning
    c. Deep Learning
    d. None of the above

31._____ is a program that has been trained to recognize patterns using a set of data.
a. AI model
b. Dataset
c. Visualization
d. None of the above

32.Type of AI model are _____.
a. Lesson Based and Rood Based
b. Learning Based and Rule Based
c. Machine Learning and Visualization
d. None of the above

33._____refers to AI modelling in which the developer hasn't specified the relationship or patterns in the data.
a. Learning Based
b. Rule Based
c. Decision Tree
d. None of the above

34. After a model has been created and trained, it must be thoroughly tested in order to determine its efficiency and performance; this is known as _____.
a. Evaluation
b. Learning
c. Decision
d. None of the above

35.Which of the following is the first and the crucial stage of AI Project development which focuses on identifying and understanding problems?
a) *Problem Scoping* (ii) Data Acquisition (iii) Data Exploration (iv) Modelling

36.…… refer to the type of data to be collected.
a) Data security (ii) Data policy (iii) Data quality (iv) *Data features*

37.Which of the following uses dots to represent the relationship between two different numeric variables represented on the x and y axis?
a) Histogram (ii) Scatter plot (iii) Bullet Graphs (iv) Tree Diagram

38.Statement A: Neural networks are made up of layers of neurons.
Statement B: Human brain consists of millions of neurons.
i)Only Statement A is correct (ii) Only Statement B is correct
(iii) *Both the statements are correct* (iv) None of the statements is correct

39. The process of developing AI machines has different stages that are collectively known as Al …… .

a) Project status (ii) Project cycle (iii) Both a) and (b) (iv) None of these

TWO MARK QUESTIONS

1) **Define AI Project Cycle, Name all the stages of an AI Project cycle.**

Ans) Project Cycle is a step-by-step process to solve problems using proven scientific methods and
drawing inferences about them. The AI Project Cycle provides us with an appropriate framework which can lead us towards the goal.
The AI Project Cycle mainly has 5 stages: They are
a) Problem Scoping b) Data Acquisition c) Data Exploration d) Modelling e) Evaluation.

2) **Name the 4Ws of problem canvases under the problem scoping stage of the AI Project Cycle.**

Ans) a. Who, b. What c. Where d. Why

3) **What is a problem statement template and what is its significance?**

Ans) The problem statement template gives a clear idea about the basic framework required to achieve the goal. It is the 4Ws canvas which segregates; , who is affected, what is the problem, where does it arise, why is it a problem? It takes us straight to the goal.

4) **What is the need of an AI Project Cycle? Explain.**

Ans) Project cycle is the process of planning, organizing, coordinating, and finally developing a project effectively throughout its phases, from planning through execution then completion and review to achieve pre-defined objectives. Our mind makes up plans for every task which we have to accomplish which is why things become clearer in our mind. Similarly, if we have to develop an AI project, the AI Project Cycle provides us with an appropriate framework which can lead us towards the goal. The major role of AI Project Cycle is to distribute the development of AI project in various stages so that the development becomes easier, clearly understandable and the steps / stages should become more specific to efficiently get the best possible output. It mainly has 5 ordered stages which distribute the entire development in specific and clear steps: These are Problem Scoping, Data Acquisition, Data Exploration, Modelling and Evaluation.

5) **What is Sustainable development?**

ANS – Sustainable development is the development that satisfies the needs of the present without compromising the capacity of future generations.
This was a warning to all countries about the effects of globalization and economic growth on the environment.

6) How many goals are there in Sustainable Development? Mention any two goals

ANS – In 2015, The general assembly of UN adopted the 2030 agenda for SD based on the principle "Leaving None Behind". The 17 goals in Sustainable Development goals are –

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

7) Why we need to explore data through visualization?

Ans) 1) We want to quickly get a sense of the trends, relationships, and patterns contained within
the data.
2) It helps us define strategy for which model to use at a later stage.
3) Visual representation is easier to understand and communicate to others.

8) What precautions to be taken while acquiring data for developing an AI Project?

Ans) Data should be collected from an authentic source, and should be accurate. The redundant and irrelevant data should not be a part of prediction.

9) Explain Data Exploration Stage.

Ans) In this stage of project cycle, we try to interpret some useful information out of the data we have
acquired. For this purpose, we need to explore the data and try to put it uniformly for a better
understanding. This stage deals with validating or verification of the collected data and to analyse
that:

➢ The data is according to the specifications decided.

➢ The data is free from errors.

➢ The data is meeting our needs

10) What are the features of an Artificial Neural Network?

Ans) Any Artificial Neural Network, irrespective of the style and logic of implementation, has a few basic features as given below.

- The Artificial Neural Network systems are modelled on the human brain and nervous system.
- They are able to automatically extract features without feeding the input by programmer.
- Every node of layer in a Neural Network is compulsorily a machine learning algorithm.
- It is very useful to implement when solving problems for very huge datasets.

11) Explain Rule-based AI modelling approaches.

Ans) Rule Based Approach: It refers to the AI modelling where the relationship or patterns in data are defined by the developer. The machine follows the rules or instructions mentioned by the developer, and performs its task accordingly. For example, suppose you have a dataset comprising of 100 images of apples and 100 images of bananas. To train your machine, you feed this data into the machine and label each image as either apple or banana. Now if you test the machine with the image of an apple, it will compare the image with the trained data and according to the labels of trained images, it will identify the test image as an apple. This is known as Rule based approach. The rules given to the machine in this example are the labels given to the machine for each image in the training dataset.

12) Explain learning-based AI modelling approaches.?

Ans) Learning Based Approach: In this approach, the machine learns by itself. It refers to the AI modelling where the relationship or patterns in data are not defined by the

developer. In this approach, random data is fed to the machine to figure out patterns and trends out of it. Generally, this approach is followed when the data is un labelled and too random for a human to make sense out of it. For example, suppose you have a dataset of 1000 images of random stray dogs of your area. You would put this into a learning approach-based AI machine and the machine would come up with various patterns it has observed in the features of these 1000 images which you might not have even thought of!

13) Explain the Supervised Learning

Ans) a) Supervised learning is an approach to creating artificial intelligence (AI), where the program is given labelled input data and the expected output results. OR Supervised learning is a learning in which we teach or train the machine using data which is well labelled that means some data is already tagged with the correct answer. After that, the machine is provided with a new set of examples (data) so that supervised learning algorithm analyses the training data (set of training examples) and produces a correct outcome from labelled data. In a supervised learning model, the dataset which is fed to the machine is labelled. It means some data is already tagged with the correct answer. In other words, we can say that the dataset is known to the person who is training the machine only then he/she is able to label the data.

14) Explain the Unsupervised Learning

Ans) Unsupervised Learning: An unsupervised learning model works on unlabelled dataset. This means that the data which is fed to the machine is random and there is a possibility that the person who is training the model does not have any information regarding it. The unsupervised learning models are used to identify relationships, patterns and trends out of the data which is fed into it. It helps the user in understanding what the data is about and what are the major features identified by the machine in it.

15) Explain the graphical representation of Classification AI model.

Ans) Classification: The classification Model works on the labelled data. For example, we have 3 coins of different denomination which are labelled according to their weight then the model would look for the labelled features for predicting the output. This model works on discrete dataset which means the data need not be continuous.

16) Draw the graphical representation of Regression AI model.

Regression: These models work on continuous data to predict the output based on patterns. For example, if you wish to predict your next salary, then you would put in the data of your previous salary, any increments, etc., and would train the model. Here, the data which has been fed to the machine is continuous.

UNIT-3: ADVANCE PYTHON

ADVANCE PYTHON

Advanced Python refers to the expert-level concepts, techniques, and libraries that go beyond the basics of the Python programming language. It includes:

- Advanced data structures and algorithms
- Decorators, generators, and asynchronous programming
- Web development frameworks like Django and Flask
- Data analysis and visualization libraries like Pandas, NumPy, and Matplotlib
- Machine learning libraries like scikit-learn and TensorFlow
- Object-Oriented Programming (OOP) concepts and design patterns
- Regular Expressions (regex) and advanced text processing
- Concurrency and parallel processing
- Debugging and testing techniques
- Advanced numerical computing and scientific computing

Mastering advanced Python concepts allows you to:

- Build complex applications and systems
- Optimize code performance and efficiency
- Work with large datasets and perform data analysis
- Build machine learning models and predictive systems
- Create web applications and RESTful APIs
- Automate tasks and workflows

Some advanced Python concepts also include:

- Lambda functions
- Map, filter, and reduce
- Context managers
- Descriptor protocols
- Metaclasses

(ONE MARK QUESTIONS)

1. What is the purpose of a decorator in Python?
    a) To decorate code with colors
    b) To modify or extend function behavior
    c) To print output
    d) To raise errors

Answer: b) To modify or extend function behavior

2. What is a generator in Python?
   a) A special type of list
   b) A function that generates a sequence of values
   c) A type of dictionary
   d) A class

Answer: b) A function that generates a sequence of values

3. What is asynchronous programming used for in Python?
   a) To run code synchronously
   b) To perform multiple tasks concurrently
   c) To slow down code execution
   d) To print output

   Answer: b) To perform multiple tasks concurrently

4. What is the purpose of the "async" and "await" keywords in Python?
   a) To define asynchronous functions and pause their execution
   b) To print output
   c) To raise errors
   d) To decorate code

   Answer: a) To define asynchronous functions and pause their execution

5. What is the main advantage of using NumPy arrays over Python lists?
   a) Slower performance
   b) Faster performance and efficient memory usage
   c) Less memory usage
   d) More memory usage

   Answer: b) Faster performance and efficient memory usage

6. What is the purpose of the "pip" package manager in Python?
   a) To install packages
   b) To write code
   c) To run code
   d) To debug code

   Answer: a) To install packages

7. What is the purpose of the "@" symbol in Python decorators?
   Answer: To indicate a decorator.

8. What is the name of the built-in Python module for asynchronous programming?
   Answer: asyncio.

9. What is the main benefit of using generators in Python?
   Answer: Memory efficiency.

10. What is the name of the popular Python library for data analysis and manipulation?
    Answer: pandas.

11. What is the purpose of the "async" keyword in Python?
    Answer: To define an asynchronous function.

12. What is the name of the Python library for machine learning and data modeling?
    Answer: scikit-learn.

13. What is the purpose of the "await" keyword in Python?
    Answer: To suspend the execution of an asynchronous function.

14. What is the name of the Python library for natural language processing?
    Answer: NLTK.

15. What is the purpose of the "yield" keyword in Python?
    Answer: To define a generator function.

(TWO MARKS QUESTIONS)

1. What is the difference between a generator and an iterator in Python?
   Answer: A generator is a function that returns an iterator, while an iterator is an object that keeps state and returns the next value on each iteration.

2. How do you define a decorator in Python?
   Answer: A decorator is defined using the "@" symbol followed by a function that takes another function as an argument and returns a new function.

3. What is the purpose of the "asyncio" module in Python?
   Answer: The "asyncio" module provides support for asynchronous programming, allowing you to write single-threaded concurrent code using coroutines, multiplexing I/O access over sockets and other resources, and implementing network clients and servers.

4. What is the difference between "join()" and "concat()" in Pandas?

Answer: "join()" is used to join two DataFrames based on a common column, while "concat()" is used to concatenate two or more DataFrames along a particular axis.

5. What is the purpose of the "yield from" statement in Python?

Answer: The "yield from" statement is used to delegate iteration to another iterator, allowing you to chain generators together.

6. How do you define a class decorator in Python?

Answer: A class decorator is defined using the "@classmethod" decorator and a function that takes a class as an argument and returns a new class.

7. What is the purpose of the "groupby()" function in Pandas?

Answer: The "groupby()" function is used to group data by one or more columns and perform aggregation operations on the grouped data.

8. What is the difference between "sort()" and "sorted()" in Python?

Answer: "sort()" is a list method that sorts the list in-place, while "sorted()" is a built-in function that returns a new sorted list without modifying the original list.

9. What is the difference between collections. Counter and collections. Default dict?

Answer: Counter is a dictionary subclass for counting hashable objects, while defaultdict is a dictionary subclass that calls a factory function to supply missing values.

10. Hat is the purpose of the functools. wraps decorator?

Answer: It preserves the metadata (name, docstring, etc.) of the original function.

11. How do you define a dataclass in Python?

Answer: Using the @dataclass decorator.

12. What is the difference between pandas. DataFrame.merge and pandas.DataFrame.join?

Answer: pandas.DataFrame.merge is used for merging on a common column, while pandas.DataFrame.join is used for joining on an index.

13. What is the purpose of the concurrent. futures module in Python?

Answer: It provides a high-level interface for asynchronously executing callables.

14. How do you define a metaclass in Python?

Answer: Using the __metaclass__ attribute or the metaclass parameter in the type function.

15. What is the purpose of the __(link unavailable) file in a Python package?
Answer: It indicates that the directory should be treated as a package.

(FIVE MARKS QUESTIONS)

1. Explain the concept of coroutines in Python and how they are used in asynchronous programming. Provide an example of a coroutine-based asynchronous function.
Answer: Coroutines in Python are special functions that can be paused and resumed during execution, allowing for cooperative multitasking. They are used in asynchronous programming to enable concurrent execution of tasks without blocking the main program flow.

In Python, coroutines are implemented using the async and await keywords. An async function is a coroutine that can be paused and resumed, while an await expression suspends the execution of a coroutine until a specific condition is met.

Here's an example of a coroutine-based asynchronous function:

```
async def fetch_data(url):
    async with aiohttp. ClientSession() as session:
        async with session.get(url) as response:
            data = await response.text()
            return data
```

In this example, the fetch_data function is an asynchronous coroutine that uses the aiohttp library to fetch data from a given URL. The async with statement creates a context manager that ensures the session and response objects are properly closed.

The await expression suspends the execution of the coroutine until the response text is available. Once the data is received, the coroutine resumes execution and returns the fetched data.

To run this coroutine, you would use the asyncio library:

```
import asyncio

async def main():
    data = await fetch_data("(link unavailable)")
    print(data)
```

```
asyncio.run(main())
```

This code defines a main coroutine that calls the fetch_data coroutine and prints the result. The asyncio.run function runs the main coroutine to completion.

Coroutines enable efficient and scalable asynchronous programming in Python, allowing you to write concurrent code that's easy to read and maintain.

2. Describe the difference between the pandas.DataFrame.apply method and the pandas.DataFrame.applymap method. Provide an example of when you would use each.
Answer: The apply and applymap methods in pandas DataFrame are used to apply functions to the data, but they differ in their scope and usage:

apply method:

- Applies a function along an axis (rows or columns) of the DataFrame.
- Can be used to perform operations on entire rows or columns at once.
- Returns a Series or DataFrame, depending on the output of the applied function.

Example:

```
import pandas as pd

# create a sample DataFrame
data = {'A': [1, 2, 3], 'B': [4, 5, 6]}
df = pd.DataFrame(data)

# define a function to calculate the square of a row
def square_row(row):
    return row ** 2

# apply the function to each row
result = df.apply(square_row, axis=1)
print(result)
```

Output:

```
A  B
0  1 16
1  4 25
2  9 36
```

applymap method:

- Applies a function element-wise to each cell in the DataFrame.
- Can be used to perform operations on individual elements.
- Returns a DataFrame with the same shape as the original.

Example:

```
import pandas as pd

# create a sample DataFrame
data = {'A': [1, 2, 3], 'B': [4, 5, 6]}
df = pd.DataFrame(data)

# define a function to calculate the square of a number
def square(x):
    return x ** 2

# apply the function to each element
result = df.applymap(square)
print(result)
```

Output:

```
A  B
0   1 16
1   4 25
2   9 36
```

3. Explain the concept of meta classes in Python and how they are used to customize class creation. Provide an example of a simple meta class that adds a new attribute to a class.

Answer: Meta classes in Python are classes that create classes. They are used to customize the creation of classes, allowing you to modify or extend the class definition before it's created. A meta class is a class that inherits from type and defines a __new__ method, which is responsible for creating the new class.

Here's a simple example of a meta class that adds a new attribute to a class:

```
class AddAttributeMeta(type):
    def __new__(cls, name, bases, namespace):
        # Create the new class
        new_class = super().__new__(cls, name, bases, namespace)
```

```
        # Add a new attribute to the class
        new_class.new_attribute = "This attribute was added by the metaclass"

        return new_class

# Use the metaclass to create a class
class MyClass(metaclass=AddAttributeMeta):
    pass

# The new class has the added attribute
print(MyClass.new_attribute)  # Output: This attribute was added by the metaclass
```

In this example, the AddAttributeMeta metaclass inherits from type and defines a __new__ method. This method is called when a new class is created using the metaclass. The method creates the new class using the super().__new__ call, and then adds a new attribute new_attribute to the class.

The MyClass class is created using the AddAttributeMeta metaclass, and as a result, it has the added attribute new_attribute.

Metaclasses are powerful tools for customizing class creation, and can be used for a wide range of tasks, such as:

- Adding new attributes or methods to classes
- Modifying the class hierarchy
- Enforcing certain constraints or conventions on class definitions
- Creating classes dynamically based on certain conditions

However, metaclasses can also make the code harder to understand and debug, so they should be used judiciously and only when necessary.

4. Describe the difference between the functools.partial function and the functools.reduce function. Provide an example of when you would use each.
Answer: The functools.partial and functools.reduce functions in Python are both higher-order functions, but they serve different purposes:

functools.partial:

- Creates a new function that "partially applies" a given function by fixing some of its arguments.
- Returns a new function that can be called with the remaining arguments.

Example:

```
from functools import partial

def add(x, y, z):
    return x + y + z

add_5_3 = partial(add, 5, 3)
result = add_5_3(2)  # calls add(5, 3, 2)
print(result)  # Output: 10
```

In this example, partial creates a new function add_5_3 that has x and y fixed to 5 and 3, respectively. When we call add_5_3(2), it's equivalent to calling add(5, 3, 2).

functools.reduce:

- Applies a binary function to an iterable, reducing it to a single output.
- Returns the accumulated result of applying the function to the first two elements, then to the result and the next element, and so on.

Example:

```
from functools import reduce

numbers = [1, 2, 3, 4, 5]
product = reduce(lambda x, y: x * y, numbers)
print(product)  # Output: 120
```

In this example, reduce applies the multiplication function to the elements of the list, starting from the first two elements (1 and 2), then to the result (2) and the next element (3), and so on, until the final result is calculated.

In summary:
- functools.partial creates a new function with some arguments fixed, while
- functools.reduce applies a function to an iterable, reducing it to a single output.

Use partial when you need to create a new function with some arguments pre-set, and reduce when you need to aggregate values from an iterable using a binary function.

5.Explain the concept of descriptor protocols in Python and how they are used to implement advanced attribute access and behavior. Provide an example of a simple descriptor that implements a read-only attribute.

Answer: Descriptors in Python are a way to customize attribute access and behavior. They are special objects that implement the descriptor protocol, which consists of the __get__, __set__, and __delete__ methods. These methods are called by Python when an attribute is accessed, set, or deleted, respectively.
Descriptors are used to implement advanced attribute access and behavior, such as:

- Read-only or write-only attributes
- Computed attributes (attributes whose value is computed on the fly)
- Validation of attribute values
- Caching of attribute values
- Lazy loading of attribute values

Here's an example of a simple descriptor that implements a read-only attribute:

```
class ReadOnlyDescriptor:
    def __init__(self, value):
        self.value = value

    def __get__(self, obj, objtype):
        return self.value

    def __set__(self, obj, value):
        raise AttributeError("Can't set read-only attribute")

class MyClass:
    my_attribute = ReadOnlyDescriptor("Initial value")

obj = MyClass()
print(obj.my_attribute)  # Output: Initial value
obj.my_attribute = "New value"  # Raises AttributeError
```

In this example, the ReadOnlyDescriptor class implements the descriptor protocol. The __get__ method returns the value of the attribute, and the __set__ method raises an AttributeError to prevent the attribute from being set.

The MyClass class uses the ReadOnlyDescriptor to define a read-only attribute my_attribute. When we try to set the attribute, the __set__ method raises an error.
Descriptors are a powerful tool for customizing attribute access and behavior in Python. They can be used to implement a wide range of advanced features and patterns, such as caching, validation, and more.

UNIT-4: DATA SCIENCE

DATA SCIENCE

Data science is a field that combines statistics, computer science, and domain expertise to extract insights and knowledge from data. It involves using various techniques such as machine learning, data visualization, and statistical modeling to analyze and interpret complex data sets.

The uses of data science are numerous and diverse, including:

1. Predictive maintenance: Predicting equipment failures and scheduling maintenance.
2. * Fraud detection*: Identifying unusual patterns and anomalies to detect fraud.
3. Recommendation systems: Personalized product recommendations based on user behavior.
4. Healthcare: Analyzing medical data to improve patient outcomes and reduce costs.
5. Customer segmentation: Grouping customers based on behavior and preferences.
6. Supply chain optimization: Optimizing logistics and inventory management.
7. Image and speech recognition: Developing AI-powered recognition systems.
8. Climate change analysis: Analyzing data to understand and mitigate climate change.
9. Business intelligence: Informing business decisions with data-driven insights.
10. Social media analysis: Analyzing social media data to understand public opinions and trends.

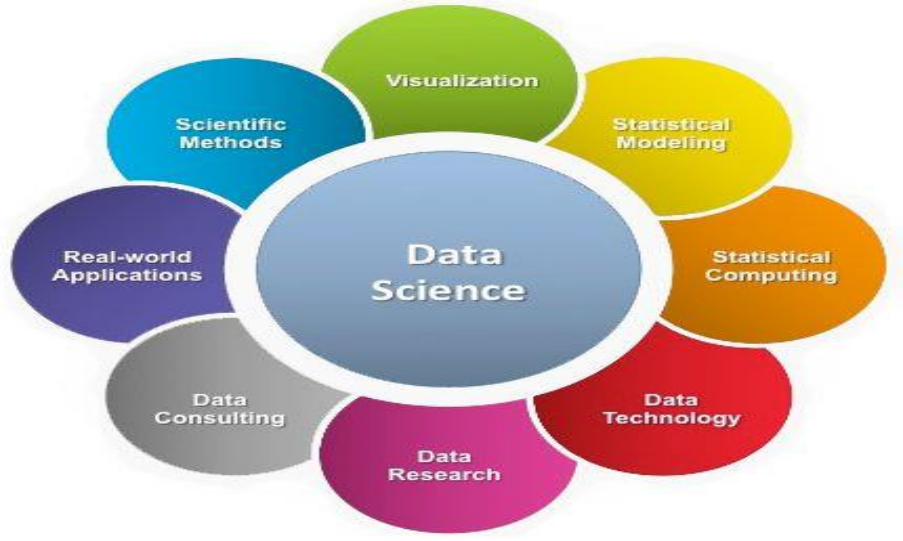
These are just a few examples of the many uses of data science. The field is constantly evolving and has the potential to transform various industries and aspects of our lives.
Here are some of the advantages and disadvantages of data science

Advantages:

- Better decision-making: Data science helps businesses and organizations make better-informed decisions.
- Improved efficiency: Data science can help companies and organizations streamline their operations by identifying inefficiencies and areas for improvement.
- Enhanced customer experience: Data science can help businesses and organizations tailor their products and services to better meet the needs of their target audience.
- Predictive analytics: Data science can be used for predictive analytics, which involves using data to forecast future trends and outcomes.
- Innovation and new discoveries: Data science can lead to new discoveries and innovations by revealing previously unknown relationships and insights in data.

Disadvantages:

- Data privacy concerns: There is a risk of data privacy concerns when data is collected and analyzed.
- Bias in data: Data can be biased due to many factors, such as the selection of the data or the way it is collected.
- Misinterpretation of data: Data science involves complex statistical analysis, which can sometimes lead to misinterpretation of the data.
- Data quality issues: Data science depends on the quality of the data used. If the data is not accurate, complete or consistent, it can lead to incorrect results.
- Cost and time: Data science can be time-consuming and expensive.



(ONE MARK QUESTIONS)

1. What is the primary goal of data science?
   Answer: To extract insights and knowledge from data.

2. Which technique is used to build predictive models?
   Answer: Machine learning.

3. What is the term for the process of cleaning and preparing data?
   Answer: Data preprocessing.

4. Which data science tool is used for data visualization?
   Answer: Tableau (or Power BI, Matplotlib, Seaborn, etc.).

5. What is the name of the popular programming language used in data science?
   Answer: Python (or R, SQL, etc.).

6. Which algorithm is used for clustering data?
   Answer: K-means (or Hierarchical Clustering, DBSCAN, etc.).

7. What is the term for the process of reducing data dimensions?
   Answer: Dimensionality reduction.

8. Which technique is used to analyze text data?
   Answer: Natural Language Processing (NLP).

9. What is the name of the popular data science framework?
   Answer: scikit-learn (or TensorFlow, PyTorch, etc.).

10. Which data science technique is used to analyze time-series data?
    Answer: Time-series analysis (or Forecasting).

11. What is data science?
    Answer: The extraction of insights and knowledge from data.

12. Which programming language is widely used in data science?
    Answer: Python.

13. What is machine learning?
    Answer: A subset of AI that involves training algorithms to make predictions.

14. What is data preprocessing?
    Answer: The process of cleaning and preparing data for analysis.

15. What is data visualization?
    Answer: The process of creating graphical representations of data.

(TWO MARKS QUESTIONS)

1. What is the goal of data visualization?
   Answer: To communicate insights and patterns in data through graphical representations.

2. Which algorithm is used for finding the most important features in a dataset?
   Answer: Principal Component Analysis (PCA).

3. What is the name of the technique used to handle missing values in a dataset?
   Answer: Imputation.

4. Which type of machine learning model is used for recommending systems?
   Answer: Collaborative Filtering.

5. What is the name of the popular data science tool used for data manipulation and analysis?
   Answer: Pandas.

6. Which technique is used to evaluate the performance of a machine learning model?
   Answer: Cross-validation. (2 marks)

7. What is the name of the algorithm used for clustering data?
   Answer: K-Means. (2 marks)

8. Which type of data is used to train a machine learning model?
   Answer: Training data. (2 marks)

9. What is the name of the technique used to reduce the dimensionality of a dataset?
   Answer: Feature selection.

10. Which machine learning model is used for predicting continuous outcomes?
    Answer: Regression.

11. What is the name of the popular data science library used for machine learning?
    Answer: scikit-learn.

12. Which technique is used to select the most important features in a dataset?
    Answer: Feature engineering.
13. What is the name of the algorithm used for text classification?
    Answer: Naive Bayes.

(FIVE MARKS QUESTIONS)

1. Describe the steps involved in the data science workflow.
   Answer: The data science workflow typically involves:
   - Problem definition and hypothesis formation
   - Data collection and cleaning
   - Data exploration and visualization
   - Modeling and evaluation

- Deployment and maintenance

2. Explain the concept of overfitting in machine learning and how it can be prevented.
   Answer: Overfitting occurs when a model is too complex and performs well on training data but poorly on new data. Techniques to prevent overfitting include:
   - Regularization (L1, L2)
   - Early stopping
   - Data augmentation
   - Cross-validation
   - Ensemble methods

3. What is feature engineering, and how is it important in data science?
   Answer: Feature engineering is the process of selecting and transforming variables to create new features that improve model performance. It's important because:
   - It helps reduce dimensionality
   - Improves model interpretability
   - Enhances model performance
   - Reduces noise and correlations
   - Facilitates feature selection

4. Describe the difference between supervised, unsupervised, and reinforcement learning.
   Answer: Supervised learning involves labeled data and predicts outcomes. Unsupervised learning involves unlabeled data and discovers patterns. Reinforcement learning involves an agent learning from interactions with an environment to maximize rewards.

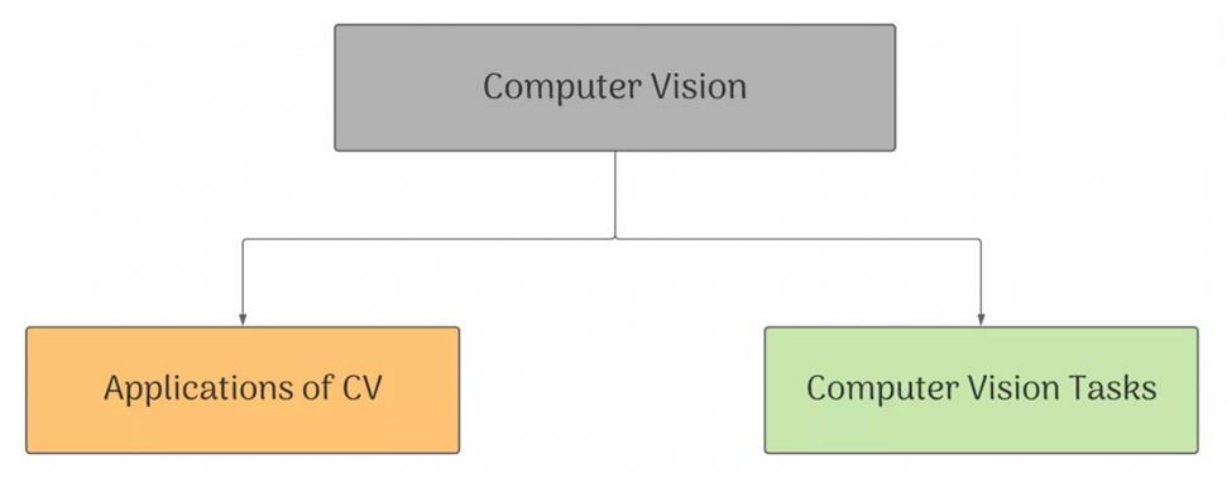
5. Explain the concept of bias and variance in machine learning and how they affect model performance.
   Answer: Bias refers to systematic error, while variance refers to model sensitivity to data. High bias leads to under fitting, while high variance leads to overfitting. The goal is to balance bias and variance to achieve optimal model performance.

UNIT-5: COMPUTER VISION

Introduction to Computer Vision

Computer vision is a branch in the **Domain of AI** that enables computers to analyze meaningful information from images, videos, and other visual inputs.

Computer vision is the same as the human eye, it enables us see-through images or visual data, process and analyses them on the basis of algorithms and methods in order to analyse actual phenomena with images.



Applications of Computer Vision

This decade and the upcoming one can witness a significant leap in technology that has put computer vision on the priority list. Some common uses of Computer Vision are:

Facial recognition

The most frequently used technology is smartphones. It is a technology to remember and verify a person, object, etc from the visuals from the given pre-defined data. Such kinds of mechanics are often used for security and safety purposes.

For eg: Face security lock-in devices and traffic cameras are some examples using facial recognition.

Facial filters

Modern days social media apps like Snapchat and Instagram use such kinds of technology that extract facial landmarks and process them using AI to get the best result.

Goggle lens

To search data, Google uses Computer vision for capturing and analysing different features of the input image to the database of images and then gives us the search.

Automotive

The machinery in industries is now using Computer vision. Automated cars are equipped with sensors and software which can detect the 360 degrees of movements determine the location, detect objects and establish the depth or dimensions of the virtual world.

For eg: Companies like Tesla are now interested in developing self-driving cars.

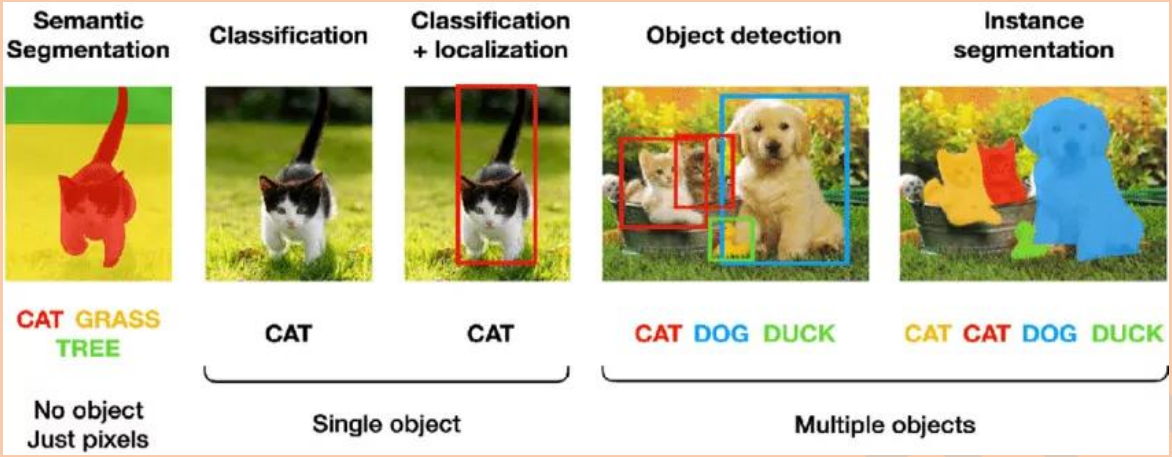
Medical Imaging

For the last decades, computer vision medical imaging application has been a trustworthy help for physicians and doctors. It creates and analyses images and helps doctors with their interpretation.

The application is used to read and convert 2D scan images into interactive 3D models.

Computer Vision Tasks

The Application of the computer is performed by certain tasks on the data or input provided by the user so it can process and analyse the situation and predict the outcome.



Single object	Multiple object
Image Classification: - Image Classification is the task of identifying an object in the input image and label from a predefined category	**Object detection:** - Object detection tasks extract features from the input and use learned formulas to recognize instances of an object category.
Classification + Localization: - As the name suggests, the task identifies the object and locates it in the input image.	**Instance segmentation**: - Instance segmentation assigns a label to each pixel of the image. It is used for tasks such as counting the number of objects

Basics of Images

The word "pixel" means a picture element.

Pixels

- Pixels are the fundamental element of a photograph.
- They are the smallest unit of information that make up a picture.
- They are typically arranged in a 2-dimensional grid.
- In general term, the more pixels you have, the more closely the image resembles the original.

Resolution

- The number of pixels covered in an image is sometimes called the resolution
- Term for area covered by the pixels in conventionally known as resolution.
- For eg :1080 x 720 pixels is a resolution giving numbers of pixels in width and height of that picture.
- A megapixel is a million pixels.

Pixel value

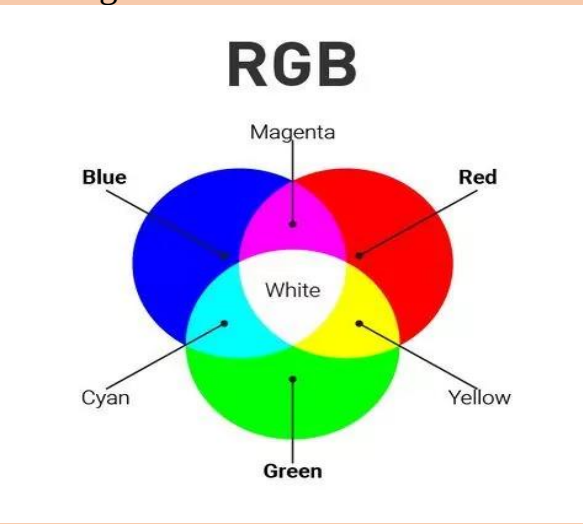
- Pixel value represent the brightness of the pixel.
- The range of a pixel value in 0-255(2^8-1)
- where 0 is taken as Black or no colour and 255 is taken as white

Why do pixel values have numbers?

Computer systems only work in the form of ones and zeros or binary systems. Each bit in a computer system can have either a zero or a one. Each pixel uses 1 byte of an image each bit can have two possible values which tells us that the 8 bits can have 255 possibilities of values that start from 0 and ends at 255.

Grayscale Images

- Grayscale images are images which have a range of shades of gray without apparent colour.
- The lightest shade is white total presence of colour or 255 and darkest colour is black at 0.
- Intermediate shades of gray have equal brightness levels of the three primary colours RBG.
- The computers store the images we see in the form of these numbers.



RBG colours

- All the coloured images are made up of three primary colours Red, Green and Blue.
- All the other colour are formed by using these primary colours at different proportions.
- Computer stores RGB Images in three different channels called the R channel, G channel and the B channel.

Image Features

- A **feature** is a description of an image.
- Features are the specific structures in the image such as points, edges or objects.
- Other examples of features are related to tasks of CV motion in image sequences, or to shapes defined in terms of curves or boundaries between different image regions.

Open CV or Open Source Computer Vision Library is that tool that helps a computer to extract these features from the images. It is capable of processing images and videos to **identify objects, faces, or even handwriting.**

Questions on Computer Vision

One Mark Questions	
Q.No	**Question**
1.	**What is the primary goal of Computer Vision?** A) To enhance image quality B) To interpret and make decisions based on visual data C) To store images efficiently D) To increase resolution of images
2.	**Which of the following is an example of an application of Computer Vision?** A) Word processing B) Speech recognition C) Facial recognition D) Data encryption
3.	**What does a pixel represent in an image?** A) A segment of a video B) The smallest unit of an image C) The color depth of an image D) The brightness of an image

4.	**Which of the following tasks involves identifying and locating objects within an image?** A) Image compression B) Feature extraction C) Object detection D) Image enhancement
5.	**A _____ is a technology based on computer vision that identifies, verifies, or matches a digital image of a human face against a database of stored facial images.**
6.	**What does segmentation in Computer Vision refer to?** A) Enhancing image details B) Dividing an image into parts or regions C) Reducing image size D) Increasing image resolution
7.	**A grayscale image represents intensity values ranging from 0 to _____.**
8.	**What is feature extraction in Computer Vision?** A) Reducing image noise B) Identifying and describing relevant characteristics from an image C) Increasing image contrast D) Storing image data
9.	**What is the main function of the Google Translate App when interpreting foreign language signs?** A) To provide dictionary definitions B) To teach grammar rules C) To translate text into your preferred language almost instantly D) To convert voice to text
10.	**What does the pixel value represent in a grayscale image?** A) The color B) The intensity C) The contrast D) The brightness
11.	**Which of the following is a common use of Computer Vision in medical imaging?** A) Audio transcription B) Image segmentation C) Video streaming D) Data encryption
12.	**Which of the following is a primary color in the RGB color model?** A) Yellow B) Cyan C) Green D) Magenta

13.	**What is a common application of Computer Vision in security systems?** A) Document editing B) Video streaming C) Facial recognition D) Web browsing
14.	**Which format is typically used to store a color image in digital form?** A) Grayscale B) Binary C) RGB D) Indexed
15.	**_____ is the core technology behind the development of autonomous vehicles**
16.	**_____allows you to point your phone's camera at the words and tell you what it means in your preferred language almost instantly**.
17.	**True/False** A higher resolution in an image implies less detail.
	Assertion Reasoning Questions
18.	**Assertion (A):** Computer vision is a field of artificial intelligence that enables computers to interpret and make decisions based on visual data from the world. **Reasoning (R):** Computer vision uses algorithms to process and analyse images and videos, enabling tasks like object detection and facial recognition. A. Both A and R are true, and R is the correct explanation for A. B. Both A and R are true, but R is not the correct explanation for A. C. A is true, but R is false. D. A is false, but R is true. E. Both A and R are false.
19.	**Assertion (A):** Image classification is the process of categorizing and labeling groups of pixels or vectors within an image based on specific rules. **Reasoning (R):** Image classification is a crucial step in medical imaging, allowing for the diagnosis of diseases from X-rays or MRI scans. A. Both A and R are true, and R is the correct explanation for A. B. Both A and R are true, but R is not the correct explanation for A. C. A is true, but R is false. D. A is false, but R is true. E. Both A and R are false.

20	**Assertion (A):** Computer vision can be used in automated quality inspection in manufacturing industries. **Reasoning (R):** Automated quality inspection systems use computer vision to identify defects or irregularities in products on a production line. A. Both A and R are true, and R is the correct explanation for A. B. Both A and R are true, but R is not the correct explanation for A. C. A is true, but R is false. D. A is false, but R is true. E. Both A and R are false.
	Subjective Questions-2 marks
1.	Explain the term "Computer Vision" and its primary goal.
2.	What is the significance of Computer Vision in AI?
3.	Name two applications of Computer Vision in the healthcare industry.
4.	Describe an application of Computer Vision in the automotive industry.
5.	What is the role of feature extraction in Computer Vision?
6.	Explain the concept of image segmentation.
7.	Differentiate between object detection and image classification.
8.	What is the significance of edge detection in Computer Vision tasks?
9.	Define pixel and explain its importance in digital images
10.	What is resolution, and how does it affect image quality?
11.	Explain the difference between grayscale and RGB images
12.	How is pixel value represented in a grayscale image?
13.	Describe the role of color channels in an RGB image.
14.	What are the advantages of using high-resolution images in Computer Vision tasks?
15.	Explain how pixel density affects the visual quality of an image.
	Subjective Questions-4 marks
1.	Explain two different real-world applications of Computer Vision and how they benefit society.
2.	Explain the concepts of pixel value, resolution, and color channels in digital images, and how they collectively affect image quality.
3.	Discuss the evolution of Computer Vision and its impact on modern technology.
4.	Describe the concept of feature extraction and its importance in different Computer Vision tasks.
5.	Compare and contrast object detection, image classification, and image segmentation in Computer Vision.
	Case Study/Application-Based Questions on Computer Vision- 5 marks

1.	**Case Study: Autonomous Vehicles** An autonomous vehicle relies on Computer Vision to navigate and make driving decisions. Explain how Computer Vision helps in tasks such as lane detection, pedestrian recognition, and traffic sign recognition. Additionally, discuss the potential challenges that the vehicle might face in adverse weather conditions and how these can be mitigated
2.	**Case Study: Medical Imaging** In the healthcare industry, Computer Vision is utilized for analysing medical images such as MRI and CT scans. Describe how Computer Vision can assist in detecting abnormalities such as tumours, and discuss the advantages of using this technology in early diagnosis and treatment planning.
3.	**Case Study: Surveillance Systems** Consider a smart surveillance system that employs Computer Vision for security purposes. Explain how object detection and facial recognition are used in this system to enhance security. What ethical considerations should be considered when implementing such a system?
4.	**Case Study: Digital Image Restoration** A company specializes in restoring old, damaged photographs using Computer Vision techniques. Explain how understanding pixel values, resolution, and color channels is crucial in this process. How does Computer Vision enhance the quality of these restored images?
5.	**Case Study: Retail Industry** In the retail industry, Computer Vision is used to improve customer experience and store management. Describe how Computer Vision can be applied for tasks such as inventory management, customer behaviour analysis, and automated checkout. What are the benefits and challenges associated with implementing these technologies in retail stores?

Answers

Q.No	One Mark Answers
1.	B) To interpret and make decisions based on visual data
2.	C) Facial recognition
3.	B) The smallest unit of an image
4.	C) Object detection
5.	facial recognition system
6.	B) Dividing an image into parts or regions

7.	255
8.	B) Identifying and describing relevant characteristics from an image
9.	C)To translate text into your preferred language almost instantly
10.	B) The intensity
11.	B) Image segmentation
12.	C) Green
13.	C) Facial recognition
14.	C) RGB
15.	Computer vision
16.	Google Translate app
17.	FALSE
18.	Both A and R are true, and R is the correct explanation for A.
19.	B) Both A and R are true, but R is not the correct explanation for A
20.	Both A and R are true, and R is the correct explanation for A.
	Subjective Questions-2 marks
1.	Computer Vision is a field of Artificial Intelligence that enables computers to interpret and make decisions based on visual data, with the primary goal of automating tasks that the human visual system can do.
2.	Computer Vision is significant in AI because it allows machines to understand and interpret visual information, leading to automation in areas like image recognition, object detection, and scene understanding, which are crucial for applications such as autonomous driving and medical imaging.
3.	Two applications of Computer Vision in healthcare are medical imaging analysis (e.g., detecting tumors in MRI scans) and surgical assistance systems (e.g., guiding robotic surgery with real-time imaging).
4.	In the automotive industry, Computer Vision is used in autonomous vehicles for tasks such as lane detection, pedestrian recognition, and traffic sign recognition, enhancing safety and enabling self-driving capabilities
5.	Feature extraction involves identifying and describing relevant characteristics from an image, which can then be used for tasks such as object recognition, classification, and tracking.
6.	Image segmentation is the process of dividing an image into multiple regions or segments, each representing a different part of the image. This helps in isolating objects and understanding the structure of the scene.
7.	Object detection identifies and locates objects within an image, providing bounding boxes for each object, whereas image classification assigns a label to the entire image based on the objects it contains without providing their locations.
8.	Edge detection is significant because it helps in identifying the boundaries and structure within an image, which is essential for object detection, segmentation,

	and recognition tasks.
9.	A pixel is the smallest unit of a digital image, representing a single point in the image with a specific color or intensity. Pixels are important because they collectively form the entire image, determining its resolution and detail.
10.	Resolution refers to the number of pixels in an image, usually measured in pixels per inch (PPI). Higher resolution means more pixels and greater detail, resulting in better image quality.
11.	Grayscale images consist of shades of gray, ranging from black to white, with each pixel representing an intensity value. RGB images use three color channels (Red, Green, Blue), where each pixel is a combination of these three colors, allowing for a wide range of colors in the image.
12.	In a grayscale image, the pixel value is represented by an intensity level ranging from 0 to 255, where 0 represents black, 255 represents white, and values in between represent different shades of gray.
13.	In an RGB image, each pixel has three color channels (Red, Green, Blue). The intensity of each channel determines the final color of the pixel. By combining different intensities of these three channels, a wide range of colors can be represented.
14.	High-resolution images provide more detail and clarity, which can improve the accuracy of Computer Vision tasks such as object detection, recognition, and segmentation, as they allow for better feature extraction and analysis.
15.	Pixel density, measured in pixels per inch (PPI), affects the sharpness and clarity of an image. Higher pixel density means more pixels are packed into a given area, resulting in a crisper and more detailed image, which is particularly important for high-quality displays and prints.
	Subjective Questions-4 marks Answers
1.	**Healthcare:** Computer Vision is used in medical imaging to detect anomalies such as tumours, improving early diagnosis and treatment outcomes. It also assists in robotic surgeries, providing precise guidance and enhancing surgical accuracy. **Security:** In security systems, Computer Vision is used for facial recognition to identify individuals in surveillance footage, aiding in crime prevention and investigation. It enhances public safety by monitoring public spaces and alerting authorities to suspicious activities.

2.	**Pixel Value:** In digital images, pixel value represents the intensity or color information of a pixel. In grayscale images, it ranges from 0 (black) to 255 (white). In RGB images, it is defined by the intensities of red, green, and blue channels. Resolution: Resolution refers to the number of pixels in an image, typically measured in pixels per inch (PPI). Higher resolution means more pixels and greater detail, enhancing image clarity and quality. **Color Channels:** In RGB images, each pixel is composed of three-color channels (red, green, blue). The combination of these channels at varying intensities produces a wide range of colors. High-quality images require accurate representation of these color channels. **Collective Impact:** High pixel values, resolution, and well-defined color channels contribute to a detailed, sharp, and color-rich image. Lower values or resolution can result in blurred, pixelated, or distorted images, reducing visual quality and effectiveness in Computer Vision tasks.
3.	Computer Vision has evolved from basic image processing techniques to advanced AI-driven algorithms that can understand and interpret complex visual data. This evolution has had a significant impact on modern technology, enabling advancements in areas such as autonomous driving, facial recognition, medical diagnostics, and augmented reality. As a result, many industries have seen improved efficiency, safety, and innovation through the integration of Computer Vision technologies.
4.	Feature extraction involves identifying and isolating significant information from an image, such as edges, textures, and shapes. This process is crucial for various Computer Vision tasks: **Object Recognition:** Features help in identifying objects within an image by matching extracted features with known patterns. **Image Classification:** Features are used to classify images into categories based on their content. **Tracking:** Extracted features allow for tracking objects across frames in video analysis, crucial for surveillance and motion detection. **Augmented Reality:** Features are used to overlay virtual objects accurately onto real-world scenes

5.	**Object Detection:** This task involves identifying and locating objects within an image, providing bounding boxes around detected objects. It focuses on detecting multiple objects and their positions. **Image Classification:** This task assigns a single label to an entire image based on its content. It does not provide the locations of objects, only categorizes the image as a whole. **Image Segmentation:** This task divides an image into segments, each representing a different object or region. It provides pixel-level classification, offering detailed information about the structure and boundaries within the image.
	Case Study/Application-Based Questions on Computer Vision- 5 marks- Answers
1.	Computer Vision helps in lane detection by using cameras to identify lane markings on the road, ensuring the vehicle stays within its lane. Pedestrian recognition involves detecting and tracking pedestrians to avoid collisions. Traffic sign recognition uses image processing to identify and interpret traffic signs, allowing the vehicle to respond accordingly. Challenges in adverse weather conditions include reduced visibility and accuracy. These can be mitigated by using additional sensors such as radar and LIDAR, as well as implementing advanced algorithms to enhance image processing in poor visibility.
2.	Computer Vision algorithms can analyze medical images to detect abnormalities like tumors by identifying unusual patterns and shapes that indicate the presence of disease. The advantages include faster and more accurate diagnosis, early detection of diseases, and improved treatment planning. This technology reduces the workload on medical professionals and increases the chances of successful treatment by identifying issues at an early stage.
3.	Object detection is used to identify and monitor objects within the surveillance area, alerting security personnel to any suspicious activity. Facial recognition identifies individuals by comparing captured images with a database of known faces, enhancing security by recognizing potential threats. Ethical considerations include privacy concerns, potential biases in recognition algorithms, and the need for transparency and accountability in how the data is used and stored.
4.	Understanding pixel values helps in identifying the intensity and color information of each pixel, which is essential for correcting damaged areas. Resolution knowledge is important for maintaining image detail during restoration. Color channels are used to accurately restore the colors in RGB images. Computer Vision enhances quality by using algorithms to fill in missing parts, correct color imbalances, and sharpen details, resulting in a restored image that closely resembles the original.

5.	Computer Vision can track inventory levels in real-time by analyzing shelf images, ensuring timely restocking. It can analyze customer behavior by monitoring movement patterns and product interactions, helping in optimizing store layout and marketing strategies. Automated checkout systems use image recognition to identify products and streamline the payment process. Benefits include increased efficiency, reduced labor costs, and improved customer satisfaction. Challenges include the high cost of implementation, potential technical issues, and ensuring data privacy and security.

UNIT-6: NATURAL LANGAUGE PROCESS (NLP)

INTRODUCTION

Computers can understand the structured form of data like spreadsheets and the tables in the database, but human languages, texts, and voices form an unstructured category of data, and it getsdifficult for the computer to understand it, and there arises the need for Natural Language Processing.

Natural Language Processing, or NLP, is the sub-field of AI that is focused on enabling computersto understand and process human languages. AI is a subfield of Linguistics, Computer Science, Information Engineering, and Artificial Intelligence concerned with the interactions between computers and human (natural) languages, in particular how to program computers to process andanalyze large amounts of natural language data

In NLP, we can break down the process of understanding English for a model into a number of small pieces.

A usual interaction between machines and humans using Natural Language Processing could go as follows:

- Humans talk to the computer
- The computer captures the audio
- There is an audio to text conversion
- Text data is processed Data is converted to audio
- The computer plays the audio file and responds to humans

Applications of Natural Language Processing

1. Chatbots

Chatbots are a form of artificial intelligence that is programmed to interact with humans in such a way that they sound like humans themselves. Chatbots are created using Natural Language Processing and Machine Learning, which means that they understand the complexities of the English language and find the actual meaning of the sentence and they also learn from their conversations with humans and become better with time. Chatbots work in two simple steps.

First, they identify the meaning of the question asked and collect all the data from the user thatmay be required to answer the question. Then they answer the question appropriately.

2. Autocomplete in Search Engines

Have you noticed that search engines tend to guess what you are typing and automatically complete your sentences? For example, on typing “game” in Google, you may get further suggestions for “game of thrones”, “game of life”or if you are interested in maths then “game theory”. All these suggestions are provided using auto complete that uses Natural Language Processing to guess what you want to ask. Search engines use their enormous data sets to analyze what their customers are probably typing when they enter particular words and suggest the most common possibilities. They use Natural Language Processing to make sense of these words and how they are interconnected to form different sentences.

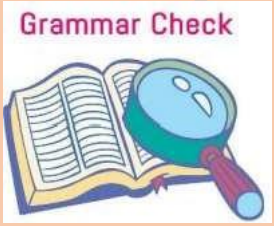
3. Voice Assistants

These days voice assistants are all the rage! Whether its Siri, Alexa, or Google Assistant, almost everyone uses one of these to make calls, place reminders, schedule meetings, set alarms, surf the internet, etc. These voice assistants have made life much easier. But how do they work? They use a complex combination of speech recognition, natural language understanding, and natural language processing to understand what humans are saying and then act on it.

4. Language Translator

Want to translate a text from English to Hindi but don't know Hindi? Well, Google Translate is the tool for you! While it's not exactly 100% accurate, it is still a great tool to convert text from one language to another. Google Translate and other translation tools as well as use Sequence to sequence modeling that is a technique in Natural Language Processing. It allows the algorithm to convert a sequence of words from one language to another which is translation.

5. Grammar Checkers



Grammar and spelling is a very important factor while writing professional reports for your superiors and even assignments for your lecturers. After all, having major errors may get you fired or failed! That's why grammar and spell checkers are a very

important tool for any professional writer. They can not only correct grammar and check spellings but also suggest better synonyms and improve the overall readability of your content. And guess what, they utilize natural language processing to provide the best possible piece of writing! The NLP algorithm is trained on millions of sentences to understand the correct format. That is why it can suggest the correct verb tense, a better synonym, or a clearer sentence structure than what you have written. Some of the most popular grammar checkers that use NLP include Grammarly, WhiteSmoke, ProWritingAid, etc.

6. Sentiment Analysis

Almost all the world is on social media these days! And companies can use sentiment analysis to understand how a particular type of user feels about a particular topic, product, etc. They can use natural language processing, computational linguistics, text analysis, etc. to understand the general sentiment of the users for their products and services and find out if the sentiment is good, bad, or neutral. Companies can use sentiment analysis in a lot of ways such as to find out the emotions of their target audience, to understand product reviews, to gauge their brand sentiment, etc. And not just private companies, even governments use sentiment analysis to find popular opinion and also catch out any threats to the security of the nation.

7. Email Classification and Filtering

Emails are still the most important method for professional communication. However, all of usstill get thousands of promotional Emails that we don't want to

read. Thankfully, our emails are automatically divided into 3 sections namely, Primary, Social, and Promotions which means we never have to open the Promotional section! But how does this work? Email services use natural language processing to identify the contents of each Email with text classification so that it can be put in the correct section. This method is not perfect since there are still some Promotional newsletters in Primary, but it's better than nothing. In more advanced cases, some companies also use specialty anti-virus software with natural language processing to scan the emails and see if there are any patterns and phrases that may indicate a phishing attempt on the employees.

8. Text Summarization

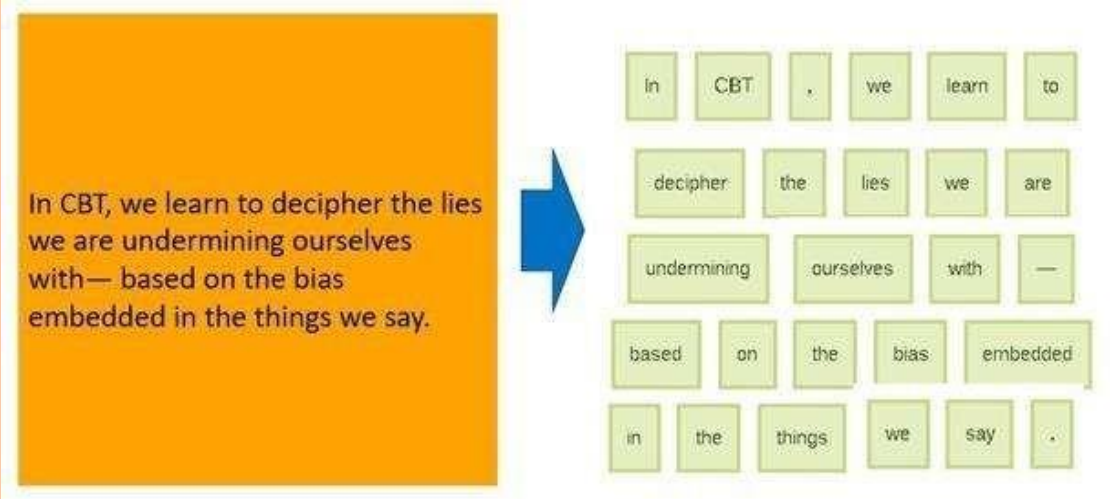
Text summarization is the process of creating a shorter version of the text with only vital information and thus, helps the user to understand the text in a shorter amount of time. The main advantage of text summarization lies in the fact that it reduces user's time in searching the important details in the document.

9. Text Classification

Texts are a form of unstructured information that possesses very prosperous records inside them. Text Classifiers categorize and arrange exceptionally a great deal with any form of textual content that we use currently. Text classification makes it possible to assign predefined categories to a document and organize it to help you find the information you need or simplify some activities.

Tokenisation

After segmenting the sentences, each sentence is then further divided into tokens. Tokens is a term used for any word or number or special character occurring in a sentence. Under tokenisation, every word, number and special character is considered separately and each of them is now a separate token.

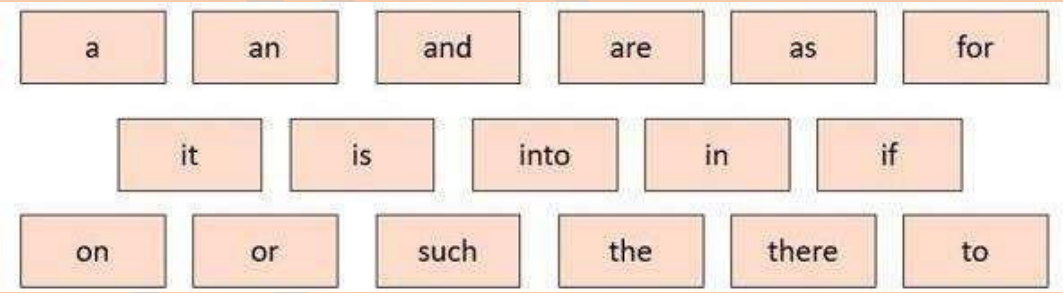


Removing Stop words, Special characters and Numbers

In this step, the tokens which are not necessary are removed from the token list. What can be thepossible words which we might not require?

Stop words are the words in any language which do not add much meaning to a sentence. Theycan safely be ignored without sacrificing the meaning of the sentence

Humans use grammar to make their sentences meaningful for the other person tounderstand.



But grammatical words do not add any essence to the information which is to be transmitted through the statement hence they come under stop words. Some examples of stop words are:

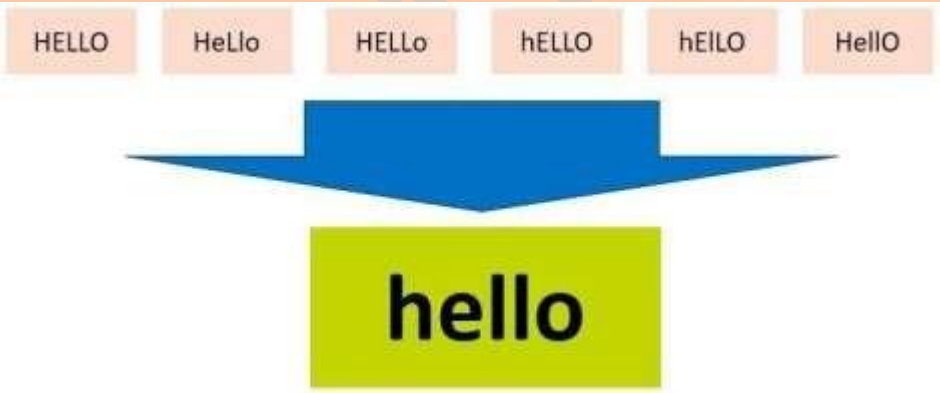
These words occur the most in any given sentence but talk very little or nothing about the contextor the meaning of it. Hence, to make it easier for the computer to

focus on meaningful terms, thesewords are removed.

Along with these words, the sentence might have special characters and/or numbers. Now it depends on the type of sentence in the documents that we are working on whether we should keep them in it or not. For example, if you are working on a document containing email IDs, then you might not want to remove the special characters and numbers whereas in some other textual data if these characters do not make sense, then you can remove them along with the stop words.

Converting text to a common case

After the stop words removal, we convert the whole text into a similar case, preferably lower case. This ensures that the case-sensitivity of the machine does not consider same words as different justbecause of different cases.



Here in this example, the all the 6 forms of hello would be converted to lower case and hencewould be treated as the same word by the machine.

Stemming

In this step, the remaining words are reduced to their root words. In other words, stemming is theprocess in which the affixes of words are removed and the words

are converted to their base form.

Note that in stemming, the stemmed words (words which are we get after removing the affixes) might not be meaningful. Here in this example as you can see:

Word	Affixes	Stem
healed	-ed	heal
healing	-ing	heal
healer	-er	heal
studies	-es	studi
studying	-ing	study

healed, healing and healer all were reduced to heal but studies was reduced to studi after the affix removal which is not a meaningful word. Stemming does not consider if the stemmed word is meaningful or not. It just removes the affixes hence it is faster.

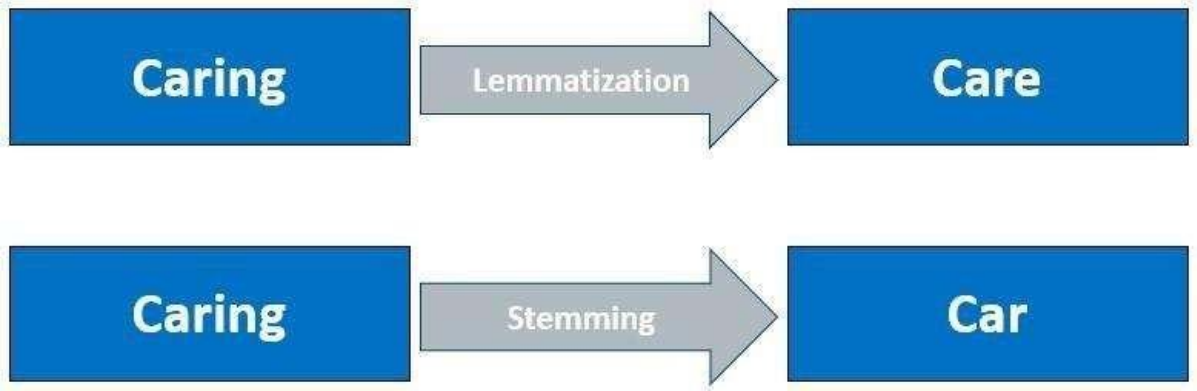
Lemmatization

Stemming and lemmatization both are alternative processes to each other as the role of both the processes is same – removal of affixes. But the difference between both of them is that in lemmatization, the word we get after affix removal (also known as lemma) is a meaningful one. Lemmatization makes sure that lemma is a word with meaning and hence it takes a longer time to execute than stemming.

Word	Affixes	lemma
healed	-ed	heal
healing	-ing	heal
healer	-er	heal
studies	-es	**study**
studying	-ing	study

As you can see in the same example, the output for studies after affix removal has become study instead of studi.

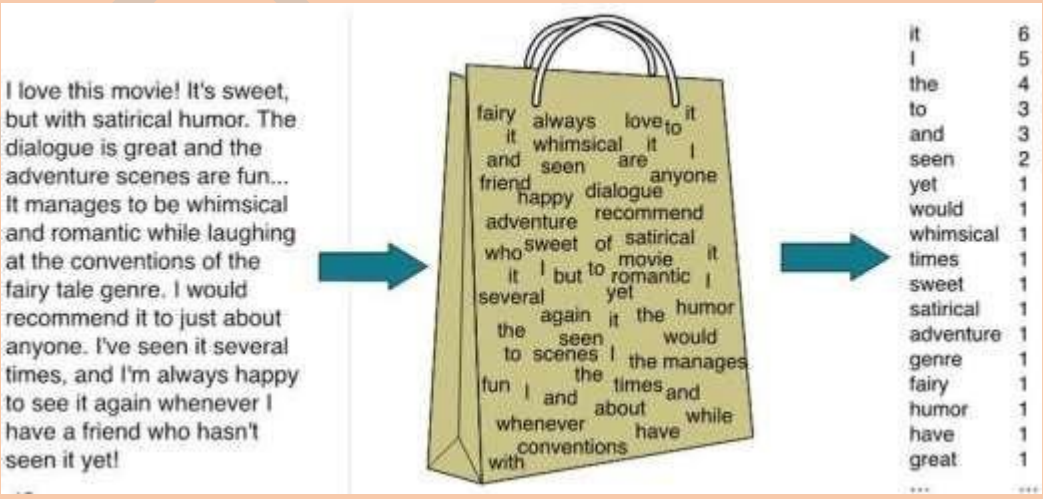
Difference between stemming and lemmatization can be summarized by this example:



With this we have normalised our text to tokens which are the simplest form of words. Now it istime to convert the tokens into numbers. For this, we would use the Bag of Words algorithm

Bag of words (BOW)

Bag of Words is a Natural Language Processing model which helps in extracting features out of the text which can be helpful in machine learning algorithms. In bag of words, we get the occurrences of each word and construct the vocabulary for the corpus.



This image gives us a brief overview about how bag of words works. As you can

see at the right, it shows us a list of words appearing in the corpus and the numbers corresponding to it shows how many times the word has occurred in the text body. Thus, we can say that the bag of words gives us two things:

- A vocabulary of words for the corpus
- The frequency of these words (number of times it has occurred in the whole corpus).

Here calling this algorithm "bag" of words symbolises that the sequence of sentences or tokens does not matter in this case as all we need are the unique words and their frequency in it.

Here is the step-by-step approach to implement bag of words algorithm:

Text Normalisation: Collect data and pre-process it

Create Dictionary: Make a list of all the unique words occurring in the corpus. (Vocabulary)

Create document vectors: For each document in the corpus, find out how many times the word from the unique list of words has occurred.

Create document vectors for all the documents. Let us go through all the steps with an example:

Step 1: Collecting data and pre-processing it.

Document 1: Aman and Anil are

stressedDocument 2: Aman went

to a therapist

Document 3: Anil went to download a health chatbot

Here are three documents having one sentence each. After text normalisation, the text becomes:

Document 1: [aman, and, anil, are,

stressed]Document 2: [aman, went,

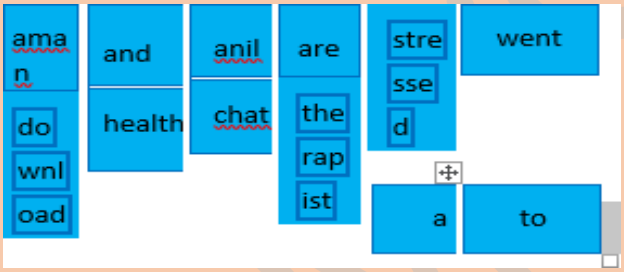
to, a, therapist]

Document 3: [anil, went, to, download, a, health, chatbot]

Note that no tokens have been removed in the stop words removal step. It is because we have very little data and since the frequency of all the words is almost the same, no word can be said to have lesser value than the other.

Step 2: Create Dictionary

Go through all the steps and create a dictionary i.e., list down all the words which occur in all three documents:

Dictionary 

Note that even though some words are repeated in different documents, they are all written just once as while creating the dictionary, we create the list of unique words.

Step 3: Create document vector

In this step, the vocabulary is written in the top row. Now, for each word in the document, if it matches with the vocabulary, put a 1 under it. If the same word appears again, increment the previous value by 1. And if the word does not occur in that document, put a 0 under it.

aman	and	anil	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0

Since in the first document, we have words: aman, and, anil, are, stressed. So, all these words geta value of 1 and the rest of the words get a 0 value.

Step 4: Repeat for all documents

Same exercise has to be done for all the documents. Hence, the table becomes:

aman	and	anil	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	0	0	0
0	0	1	0	0	1	1	1	0	1	1	1

In this table, the header row contains the vocabulary of the corpus and three rows correspond to three different documents. Take a look at this table and analyze the positioning of **0s and 1s in it.**

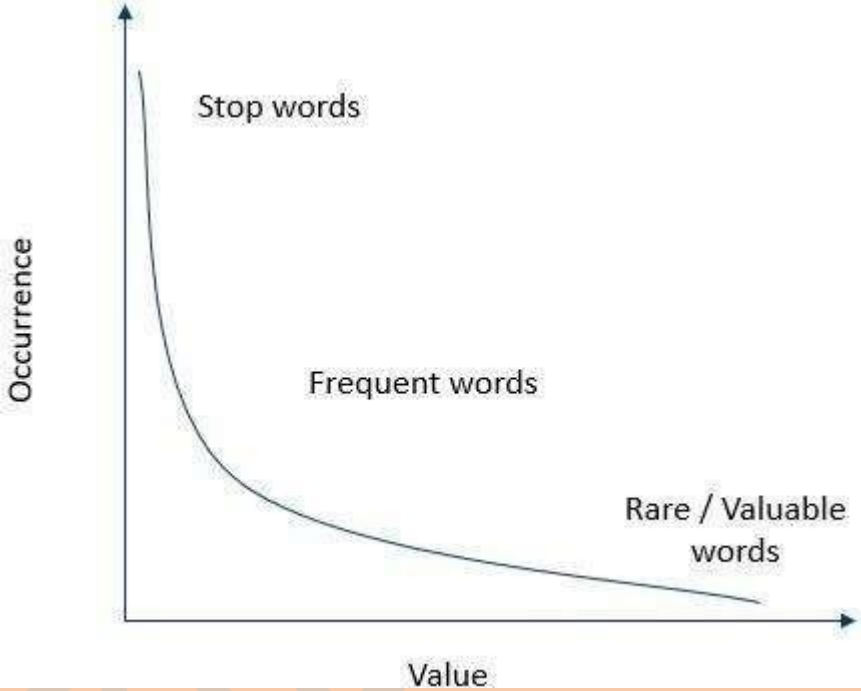
Finally, this gives us the document vector table for our corpus. But the tokens have still notconverted to numbers. This leads us to the final steps of our algorithm: TFIDF.

TFIDF: Term Frequency & Inverse Document Frequency

Bag of words algorithm gives us the frequency of words in each document we have in our corpus. It gives us an idea that if the word is occurring more in a document, its value is more for that document. For example, if I have a document on air pollution, air and pollution would be the words which occur many times in it. And these words are valuable too as they give us some context around the document. But let us suppose we have 10 documents and all of them talk about different issues. One is on women empowerment, the other is on unemployment and so on. Do you

think air and pollution would still be one of the most occurring words in the whole corpus? If not, then which words do you think would have the highest frequency in all of them?

And, this, is, the, etc. are the words which occur the most in almost all the documents. But these words do not talk about the corpus at all. Though they are important for humans as they make the statements understandable to us, for the machine they are a complete waste as they do not provide us with any information regarding the corpus. Hence, these are termed as stopwords and are mostly removed at the pre-processing stage only.



Take a look at this graph. It is a plot of occurrence of words versus their value. As you can see, if the words have highest occurrence in all the documents of the corpus, they are said to have negligible value hence they are termed as stop words. These words are mostly removed at the pre- processing stage only. Now as we move ahead from the stop words, the occurrence level drops drastically and the words which have adequate occurrence in the corpus are said to have some amount

of value and are termed as frequent words. These words mostly talk about the document's subject and their occurrence is adequate in the corpus. Then as the occurrence of words drops further, the value of such words rises. These words are termed as rare or valuable words. These words occur the least but add the most value to the corpus. Hence, when we look at the text, we take frequent and rare words into consideration.

TFIDF stands for Term Frequency and Inverse Document Frequency. TFIDF helps in identifyingthe value for each word.

Term Frequency

Term frequency is the frequency of a word in one document. Term frequency can easily be found from the document vector table as in that table we mention the frequency of each word of the vocabulary in each document.

aman	and	anil	are	stressed	went	to	a	therapist	download	health	chatbot
1	1	1	1	1	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	0	0	0
0	0	1	0	0	1	1	1	0	1	1	1

Here, you can see that the frequency of each word for each document has been recorded in the table. These numbers are nothing but the Term Frequencies!

Inverse Document Frequency

Now, let us look at the other half of TFIDF which is Inverse Document Frequency. For this, let us first understand what does document frequency mean. Document Frequency is the number of documents in which the word occurs irrespective of how many times it has occurred in those documents. The document frequency for

the exemplar vocabulary would be:

aman	and	anil	are	stressed	went	to	a	therapist	download	health	Chatbot
2	1	2	1	1	2	2	2	1	1	1	1

Here, you can see that the document frequency of 'aman', 'anil', 'went', 'to' and 'a' is 2 as they have occurred in two documents. Rest of them occurred in just one document hence the documentfrequency for them is one.

Talking about inverse document frequency, we need to put the document frequency in the denominator while the total number of documents is the numerator. Here, the total number of documents are 3, hence inverse document frequency becomes:

aman	and	anil	are	stressed	went	to	a	therapist	download	health	chatbot
3/2	3/1	3/2	3/1	3/1	3/2	3/2	3/2	3/1	3/1	3/1	3/1

Finally, the formula of TFIDF for any word W becomes:

TFIDF(W) = TF(W) * log(IDF(W))

Here, log is to the base of 10. Don't worry! You don't need to calculate the log values by yourself.Simply use the log function in the calculator and find out!

Now, let's multiply the IDF values to the TF values. Note that the TF values are for each document while the IDF values are for the whole corpus. Hence, we need to multiply the IDF values to each row of the document vectortable.

aman	and	anil	are	stress	went	to	a	therapist	download	health	chatbot
1*log(3/2)	1*log(3)	1*log(3/2)	1*log(3)	1*log(3)	0*log(3/2)	0*log(3/2)	0*log(3/2)	0*log(3)	0*log(3)	0*log(3)	0*log(3)
1*log(3/2)	0*log(3)	0*log(3/2)	0*log(3)	0*log(3)	1*log(3/2)	1*log(3/2)	1*log(3/2)	1*log(3)	0*log(3)	0*log(3)	0*log(3)
0*log(3/2)	0*log(3)	1*log(3/2)	0*log(3)	0*log(3)	1*log(3/2)	1*log(3/2)	1*log(3/2)	0*log(3)	1*log(3)	1*log(3)	1*log(3)

Here, you can see that the IDF values for Aman in each row is the same and similar pattern is followed for all the words of the vocabulary. After calculating all the values, we get

aman	and	anil	are	stress	went	to	a	therapist	download	health	chatbot
0.176	0.477	0.176	0.477	0.477	0	0	0	0	0	0	0
0.176	0	0	0	0	0.176	0.176	0.176	0.477	0	0	0
0	0	0.176	0	0	0.176	0.176	0.176	0	0.477	0.477	0.477

Finally, the words have been converted to numbers. These numbers are the values of each for each document. Here, you can see that since we have less amount of data, words like ‘are’ and ‘and’ also have a high value. But as the IDF value increases, the value of that word decreases. That is, for example:

Total Number of documents: 10

Number of documents in which ‘and’ occurs: 10

Therefore, IDF (and) = 10/10 =1

Which means: log (1) = 0. Hence, the value of ‘and’ becomes 0.

On the other hand, number of documents in which ‘pollution’

occurs: 3IDF (pollution) = 10/3 = 3.3333…

Which means: log (3.3333) = 0.522; which shows that the word ‘pollution’ has

considerable valuein the corpus.

Summarizing the concept, we can say that:

Words that occur in all the documents with high term frequencies have the least values and are considered to be the stop words.

For a word to have high TFIDF value, the word needs to have a high term frequency but less document frequency which shows that the word is important for one document but is not a commonword for all documents.

These values help the computer understand which words are to be considered while processing thenatural language. The higher the value, the more important the word is for a given corpus.

Applications of TF-IDF

Document Classification: TF-IDF helps in classifying the type and genre of a document by lookingat the frequencies of words in the text. Based on the TF-IDF values, it is easy to classify emails asspam or ham, to classify news as real or fake and so on.

Topic Modelling: It helps in predicting the topic for the corpus. Topic modelling refers to a methodof identifying short and informative descriptions of a document in a large collection that can further be used for various text mining tasks such a summarization, document classification etc.

Key word Extraction: It is also useful for extracting keywords from

text. Information Retrieval System: To extract the important

information out of a corpus.Stop word Filtering: It helps in removing

unnecessary words out of a text body.

NTLK:

NLTK is a leading platform for building Python programs to work with human language data. It provides easy-to-use interfaces to over 50 corpora and lexical resources such as WordNet, along with a suite of text processing libraries for classification, tokenization, stemming, tagging, parsing, and semantic reasoning, wrappers for industrial-strength NLP libraries, and an active discussion forum.

NLTK is suitable for linguists, engineers, students, educators, researchers, and industry users alike. NLTK is available for Windows, Mac OS X, and Linux. Best of all, NLTK is a free, open source, community-driven project.

NLTK has been called "a wonderful tool for teaching, and working in, computational linguistics using Python," and "an amazing library to play with natural language."

Natural Language Processing with Python provides a practical introduction to programming for language processing. Written by the creators of NLTK, it guides the reader through the fundamentals of writing Python programs, working with corpora, categorizing text, analyzing linguistic structure, and more.

Installing NLTK

```
pip install --user -U nltk
pip install --user -U numpy
python
import nltk
```

For older versions of Python it might be necessary to install setuptools

(see https://pypi.python.org/pypi/setuptools) and to install pip sudo easy_install pip).
(

NLTK requires Python versions 3.7, 3.8, 3.9

or 3.1032-bit binary installation

Install Python 3.8: https://www.python.org/downloads/ (avoid the 64-bit versions)Install Numpy (optional):

https://www.scipy.org/scipylib/download.html

Install NLTK: https://pypi.python.org/pypi/nltk

Test installation: Start>Python38, then type import nltk

Installing NLTK Data

After installing the NLTK package, please do install the necessary datasets/models forspecific work.

NLTK data, on the command line type python -m nltk.downloader popular, or in the Pythoninterpreter import nltk; nltk.download('popular')

QUESTION BANKS – MCQS:

1. What is NLTK tool in Python?
(a) Natural Linguistics Tool
(b) Natural Language Toolkit
(c) Neutral Language Kit
(d) Neutral Language Toolkit

2. TF-IDF in NLP is defined as:

a. Term Frequency and Definite Frequency

b. Term Frequency and Indefinite Frequency

c. Term Frequency and Inverse Document Frequency

d. Term Frequency and Integrated Document Frequency

3. What do we call the process of dividing a string into component words?

a. Regression
b. Word Tokenization
c. Classification
d. Clustering

4. "Converting text to a common case" is a step in Text Normalisation. (**True**/False)

5. The higher the value, the more important the word in the document – this is true of which model?

(a) Bag of Words

(b)TF-IDF

(c) YOLO

(d) SSD

6. Which of these is not an NLP library?

(a) NLTK

(b) **NLP Kit**

(c) Open NLP

(d) NLP Suite

7. What is a chatbot called which uses simple FAQs without any intelligence?
(a) Smart Chatbot
(b) Script Chatbot
(c) AI Chatbot
(d) ML Chatbot

8. What is the process of extracting emotions within a text data using NLP called?
   a. Sentiment Analysis
   b. Emotional Data Science
   c. Emotional Processing
   d. Emotional Classification
9. After Lemmatization, the words which we are get after removing the affixes is called
   a. Lemmat
   b. **Lemma**
   c. Lemmatiz
   d. Lemmatiza
10. _____are the words which occur very frequently in the corpus but do not add any value to it.
   a. Special Characters
   b. **Stopwords**
   c. Roman Numbers
   d. Useless Words

SUBJECTIVE TYPE QUESTIONS 2 MARKS:

1. Explain the key steps of NLP – based text analysis.
   i) Sentence Segmentation
   ii) Tokenization
   iii) Removing Stop words, Special Characters and Numbers
   iv) Stemming
   v) Converting Text to common Case
   vi) Lemmatization
2. Compare Bag of words and TF-IDF and share your finding.

   Bag of Words is a Natural Language Processing model which helps in extracting features out of the text which can be helpful in machine learning algorithms. In bag of words, we get the occurrences of each word and construct the vocabulary for the corpus. Bag of Words just creates a set of vectors containing the count of word occurrences in the document (reviews). Bag of Words vectors are easy to interpret.

   TFIDF is commonly used in the Natural Language Processing domain.

Some of its applications are:

· Document Classification - Helps in classifying the type and genre of a document.

· Topic Modelling - It helps in predicting the topic for a corpus.

· Information Retrieval System - To extract the important information out of a corpus.Stop word filtering - Helps in removing the unnecessary words out of a text body.

3. What are some of the applications of chatbots in health care?

The most valuable features of using chatbots in healthcare include:

· **Monitoring**: Awareness and tracking of user's behavior, anxiety, and weight changesto encourage developing better habits.

· **Anonymity:** Especially in sensitive and mental health issues.

· **Personalization**: Level of personalization depends on the specific application. Someapplications make use of measurements of:

. Physical vitals **(oxygenation, heart rhythm, body temperature) via mobile sensors.**

. **Patient behaviour** via facial recognition.

· **Real time interaction**: Immediate response, notifications, and reminders.

· **Scalability**: Ability to react with numerous users at the same time.

4. Explain the difference between Stemming and Lemmatization.

Stemming: Stemming is a rudimentary rule-based process of stripping the suffixes("ing", "ly", "es", "s" etc) from a word.

Stemming is a process of reducing words to their word stem, base or root form (for example, books — book, looked — look).

Lemmatization: Lemmatization, on the other hand, is an organized & step

by step procedure of obtaining the root form of the word, it makes use of vocabulary (dictionary importance of words) and morphological analysis (word structure and grammar relations).

5. What is the difference between how humans interpret communication and how NLP interpret?

The communications made by the machines are very basic and simple. Human communication is complex. There are multiple characteristics of the human language that might be easy for a human to understand but extremely difficult for a computer to understand.

For machines it is difficult to understand our language. Let us take a look at some of them here:

Arrangement of the words and meaning - There are rules in human language. There are nouns, verbs, adverbs, adjectives. A word can be a noun at one time and an adjective some other time. This can create difficulty while processing by computers.

Analogy with programming language- Different syntax, same semantics: 2+3 = 3+2 Here the way these statements are written is different, but their meanings are the same that is 5. Different semantics, same syntax: 2/3 (Python 2.7) ≠ 2/3 (Python 3) Here the statements written have the same syntax but their meanings are different. In Python 2.7, this statement would result in 1 while in Python 3, it would give an output of 1.5. Multiple Meanings of a word - In natural language, it is important to understand that a word can have multiple meanings and the meanings fit into the statement according to the context of it.

Q. No		Marks
	PART -A	
1.	Find the odd men out a) Chatbot b) Grammar Checkers c) Jabber-wacky d) PriceGrabber	1
2.	WhiteSmoke is an example of _____ domain of AI a) Data Science b) Computer Vision c) NLP d) None of these	1
3.	The Email services use _____ to identify the contents of each Email with text classification. a) Grammar checker b) Natural Language Processing c) Computer Vision d) Data Analysis	1
4.	Companies can use _____ in a lot of ways such as to find out the emotions of their target audience, to understand product reviews, to gauge their brand. a) Sentiment Analysis b) structure Analysis c) Deep Learning d)Emails	1
5.	Two main approaches to summarising text documents are a) Extractive Method & Abstractive Method b) Classification & Regression c) Clustering & calculating d) Chat box & Smart bot	1
6.	Spam filtering in email is an example of _____ a) Text summarisation b) Text Classification c) Sentiment Analysis d) None of the above	1
7.	Google Assistant, Alexa, Cortana, Siri are examples of a) Script Bot b) Smart Bot c) Sling Bot d) None of these	1

8.	_____ is a term used for any word or number or special character occurring in a sentence in Text Normalisation. a) Tokens b) Numbers c) Common case d) None of the above	1
9.	In text normalization, text from multiple documents and the term used for the whole textual data from all the documents altogether is known as _____ a) Corpus b) Tokens c) Lemma d) Stem	1
10.	Using the , we can find a vocabulary of words for the corpus and the frequency of these words (number of times it has occurred in the whole corpus.	1
11.	The process of extracting the root form of the word is known as _____ a) Tokenisation b) Stemming c) Lemmatisation d) Segmentation	1
12.	_____ is a statistical measure that evaluates how relevant a word is to a document in a collection of documents. a) TF b) IDF c) TF -IDF d) All of these	1
13.	How many tokens are there in the following sentence: “Traffic Jams have become a common part of our lives nowadays. Living in an urban area means, you have to face traffic each and every time you get out on the road. Mostly, school students opt for buses to go to school.	1
14.	NLP stands for _____. a) Natural Language Processing b) Natural Language Program c) Neural Language Program d) Natural Learning Program	1
15.	A corpus contains 4 documents in which the word ‘diet’ was appearing once in document 1. Identify the term in which we can categorise the word ‘diet’. (a) Stop word (b) Rare word (c) Frequent word (d) Removable word	1

16.	Aditi, a student of class XII developed a chatbot that clarifies the doubts of Economics students. She trained the software with lots of data sets catering to all difficulty levels. If any student would type or ask questions related to Economics, the software would give an instant reply. Identify the domain of AI in the given scenario. (a) Computer Vision (b) Data Science (c) Natural Language Processing (d) None of these	1
17.	What do you mean by syntax of a language? a) Meaning of a sentence b) Grammatical structure of a sentence c) Semantics of a sentence d) Synonym of a sentence	1
18.	There are 10 documents in which the word "and" appears totally 10 times. What is the IDF value for "and" a) 10 b)10/1 c) 1 d) 0	
19.	The formula of TFIDF for any word W is: a) TFIDF(W) = IDF(W) * log (IDF(W) b) TFIDF(W) = TF(W) * log (IDF(W) c) TFIDF(W) = IDF(W) * log (TF(W) d) TFIDF(W) = IDF(W) * log (DF(W)	1
20.	The stem of the word 'Healer' is a) Heal b) Heale c) Hea d) Healer	1
	PART -B	
21.	Differentiate between Stemming and Lemmatisation.	2
22.	Write the step-by-step approach to implement bag of words algorithm.	2
23.	Brief the terms – Stop words, frequent words and rare words.	2
24.	What is a Chatbot?	2
25.	Differentiate between a script-bot and a smart-bot. (Any 2 differences)	2
26.	Write the sentence segmentation for the following text: " Raj and Vijay are best friends. They play together with other friends. Raj likes to play football but Vijay prefers to play online games. Raj wants to be a footballer. Vijay wants to become an online gamer"	2

27.	Write the stem ans lemma words for the following: Healing, studies, studying, caring	2
28.	Define Text Summarisation.	2
29.	Identify the stop words in the given sentence: Pollution is the introduction of contaminants into the natural environment that cause adverse change. The three types of pollution are air pollution, water pollution and land pollution. Mail details pollu@gmail.com	2
30.	What is NLTK?	2
31.	While working with NLP what is the meaning of? a. Syntax b. Semantics	2
32.	What is term frequency?	2
33.	What do you mean by corpus?	2
34.	Does the vocabulary of a corpus remain the same before and after text normalization? Why?	2
35.	What is the need of text normalization in NLP?	2
	PART -C	
36.	a) Briefly explain the applications of TF-IDF b) Draw the plot of occurrence of words versus their value graph	4(3+1)
37.	Create a document vector table for the following documents Document 1: Divya and Rani both are stressed Document 2: Rani went to a therapist Document 3: Divya went to download a health chatbot	4
38.	Define Text normalization and explain the different steps in involved.	4
39.	List out the applications of Natural Language Processing.	4
40.	What is the difference between human language and computer language.	4

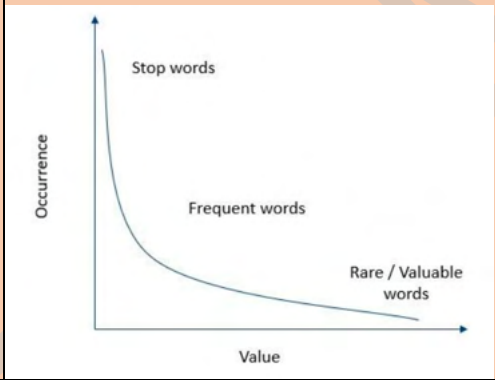
Q. No	Answers	Marks
	PART -A	
1.	d) PriceGrabber	1
2.	c) NLP	1
3.	b) Natural Language Processing	1
4.	a) Sentiment Analysis	1
5.	a) Extractive Method & Abstractive Method	1
6.	b) Text Classification	1
7.	b) Smart Bot	1
8.	a) Tokens	1
9.	b) Tokens	1
10.	Bag of words algorithm	1
11.	c) Lemmatisation	1
12.	c) TF -IDF	1
13.	47	1
14.	a) Natural Language Processing	1
15.	(b) Rare word	1
16.	(c) Natural Language Processing	1
17.	b) Grammatical structure of a sentence	1
18.	c) 1	
19.	b) TFIDF(W) = TF(W) * log (IDF(W)	1
20.	a) Heal	1
	PART -B	
21.	Stemming is the process of removing a part of a word, or reducing to its stem or root, e.g., in stemming, the word “studies” gets reduced to its stem ’studi’ with ‘ed’ removed; similarly, the word ‘advisable’ gets reduced to its stem ‘advis’. Lemmatisation is very similar to stemming, where the goal is to remove inflections from the word and map a word to its root form. But unlike stemming, lemmatisation tries to do it the proper way. It doesn’t just chop things off, it actually transforms words to the actual root, a real word in dictionary. The reduced forms resulting out of lemmatisation are called lemmas, the word ‘advisable’ gets reduced to its stem ‘advis’.	2

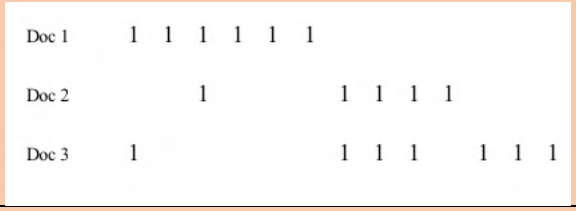
22.	1.Text Normalization: Collect data and pre-process it by removing the known stop words. 2. Design the vocabulary. Prepare the corpus (a collection of words) from the words in the document. The whole collection of textual data from all the documents is called corpus. 3. Create Document vectors. Score the word's frequency in the document. 4. Calculate TF-IDF. Calculate Term Frequency and Inverse Document Frequency.	2
23.	It is a plot of occurrence of words versus their value, if the words have highest occurrence in all the documents of the corpus, they are said to have negligible value hence they are termed as stop words. These words are mostly removed at the pre-processing stage only. The stop words, the occurrence level drops drastically and the words which have adequate occurrence in the corpus are said to have some amount of value and are termed as frequent words. These words mostly talk about the document's subject, and their occurrence is adequate in the corpus. Then as the occurrence of words drops further, the value of such words rises. These words are termed as rare or valuable words. These words occur the least but add the most value to the corpus.	2
24.	A chatbot is a computer program that can learn over time how to best interact with humans. It can answer questions and troubleshoot customer problems, evaluate and qualify prospects, generate sales leads and increase sales on an e-commerce site. OR A chatbot is a computer program designed to simulate conversation with human users. A chatbot is also known as an artificial conversational entity (ACE), chat robot, talk bot, chatterbot or chatterbox. OR A chatbot is a software application used to conduct an on-line chat conversation via text or text-to-speech, in lieu of providing direct contact with a live human agent.	2

<table>
<tr><td>25.</td><td>
<table>
<tr><td>Script-bot</td><td>Smart-bot</td></tr>
<tr><td>a. A scripted chatbot doesn’t carry even a glimpse of AI.</td><td>a. Smart bots are built on NLP and ML.</td></tr>
<tr><td>b. Script bots are easy to make Script bot functioning is very limited as they are less powerful.</td><td>b. Smart –bots are comparatively difficult to make.</td></tr>
<tr><td>c. Script bots work around a script which is programmed in them.</td><td>c. Smart-bots are flexible and powerful.</td></tr>
<tr><td>d. No or little language processing skills</td><td>e. NLP and Machine learning skills are required.</td></tr>
<tr><td>e. Limited functionality</td><td>e. Limited functionality</td></tr>
<tr><td>Example: the bots which are deployed in the customer care section of various companies</td><td>Example: Google Assistant, Alexa, Cortana, Siri, etc.</td></tr>
</table>
</td><td>2</td></tr>
<tr><td>26.</td><td>1. Raj and Vijay are best friends.
2. They play together with other friends.
3. Raj likes to play football but Vijay prefers to play online games.
4. Raj wants to be a footballer.
5. Vijay wants to become an online gamer.</td><td>2</td></tr>
<tr><td>27.</td><td>
<table>
<tr><td></td><td>Stem</td><td>Lemma</td></tr>
<tr><td>Healing</td><td>Heal</td><td>Heal</td></tr>
<tr><td>Studies</td><td>Stud</td><td>Study</td></tr>
<tr><td>Studying</td><td>Studi</td><td>Study</td></tr>
<tr><td>caring</td><td>car</td><td>care</td></tr>
</table>
</td><td>2</td></tr>
<tr><td>28.</td><td>Text summarisation is the process of creating a shorter version of the text with only vital information and thus, helps the user to understand the text in a shorter amount of time. The main advantage of text summarisation lies in the fact that it reduces user’s time in searching the important details in the document.</td><td>2</td></tr>
</table>

29.	is, the, of, that, into, are, and	2
30.	NLTK is a Python Package that you can use for NLP. It is a platform used for building Python programs that work with human language data for applying in statistical natural language processing (NLP). It contains text processing libraries for tokenisation, parsing, classification, stemming, tagging and semantic reasoning.	2
31.	Syntax: Syntax refers to the grammatical structure of a sentence. Semantics: It refers to the meaning of the sentence.	2
32.	Term frequency is the frequency of a word in one document. Term frequency can easily be found from the document vector table as in that table we mention the frequency of each word of the vocabulary in each document.	2
33.	In Text Normalization, we undergo several steps to normalize the text to a lower level. That is, we will be working on text from multiple documents and the term used for the whole textual data from all the documents altogether is known as corpus. OR A corpus is a large and structured set of machine-readable texts that have been produced in a natural communicative setting. OR A corpus can be defined as a collection of text documents. It can be thought of as just a bunch of text files in a directory, often alongside many other directories of text files.	2
34.	No, the vocabulary of a corpus does not remain the same before and after text normalization. Reasons are – ● In normalization the text is normalized through various steps and is lowered to minimum vocabulary since the machine does not require grammatically correct statements but the essence of it. ● In normalization Stop words, Special Characters and Numbers are removed. ● In stemming the affixes of words are removed and the words are converted to their base form. So, after normalization, we get the reduced vocabulary.	2
35.	Since we all know that the language of computers is Numerical, the very first step that comes to our mind is to convert our language to numbers. This conversion takes a few steps to happen. The first step to it is Text Normalization. Since human languages are complex, we need to first of all simplify them in order to make sure that the understanding becomes possible.	2

<table>
<tr><td></td><td>Text Normalization helps in cleaning up the textual data in such a way that it comes down to a level where its complexity is lower than the actual data.</td><td></td></tr>
<tr><td colspan="3">PART -C</td></tr>
<tr><td>36.</td><td>a)
Document Classification: TF-IDF helps in classifying the type and genre of a document by looking at the frequencies of words in the text. Based on the TF-IDF values, it is easy to classify emails as spam or ham, to classify news as real or fake and so on.
Topic Modelling: It helps in predicting the topic for the corpus. Topic modelling refers to a method of identifying short and informative descriptions of a document in a large collection that can further be used for various text mining tasks such a summarisation, document classification etc.
Key word Extraction: It is also useful for extracting keywords from text.
Information Retrieval System: To extract the important information out of a corpus.
Stop word Filtering: It helps in removing unnecessary words out of a text body

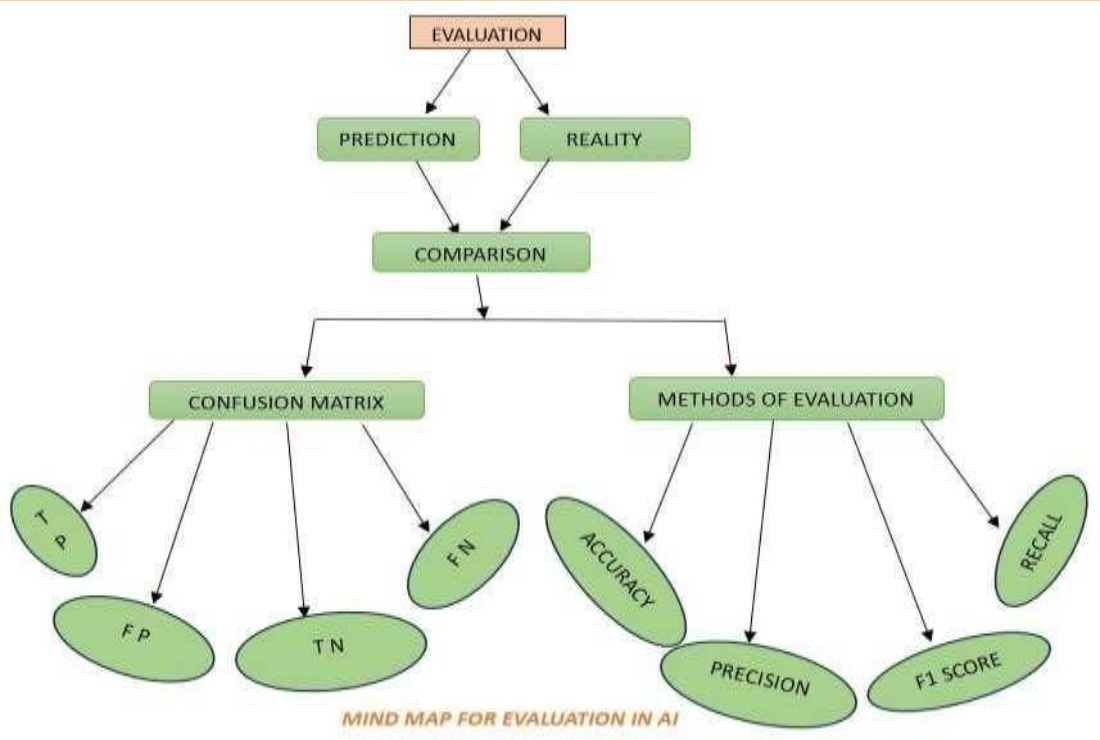
b)
 
</td><td>4</td></tr>
<tr><td>37.</td><td>After text normalization, the text would be:
Document 1: [Divya, and, Rani, both, are, stressed]
Document 2: [Rani, went to, a, therapist]
Document 3: [Divya, went to, download, a, health, chatbot]
Create a Dictionary
<table>
<tr><td>Divya</td><td>and</td><td>Rani</td><td>both</td><td>are</td><td>stressed</td></tr>
<tr><td>went</td><td>to</td><td>a</td><td>therapist</td><td>download</td><td>Health</td></tr>
<tr><td>chatbot</td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>4</td></tr>
</table>

	Create a document vector  	
38.	Text Normalization is a process to reduce the variations in text's word forms to a common form when the variation means the same thing. The different in text normalization is 1. Sentence Segmentation 2. Tokenisation 3. Removing Stop words, Special characters and Numbers 4. Converting text to a common case 5. Stemming 6. Lemmatization 1. Sentence Segmentation: Under sentence segmentation, the whole text is divided into individual sentences. 2. Tokenisation: After segmenting the sentences, each sentence is then further divided into tokens. Tokens is a term used for any word or number or special character occurring in a sentence. Under tokenisation, every word, number and special character is considered separately and each of them is now a separate token. 3. Removing Stop words, Special characters and Numbers: Stop words are the words in any language which do not add much meaning to a sentence. They can safely be ignored without sacrificing the meaning of the sentence These words occur the most in any given sentence but talk very little or nothing about the context or the meaning of it. Hence, to make it easier for the computer to focus on meaningful terms, these words are removed. 4. Converting text to a common case: After the stop words removal, we convert the whole text into a similar case, preferably lower case. This ensures that the case-sensitivity of the machine does not consider same words as different just because of different cases. 5. Stemming: -stemming is the process in which the affixes of words are removed, and the words are converted to their base form. In stemming, the stemmed words (words which are we get after removing the affixes) might not be meaningful.	4

	6. Lemmatization: In lemmatization, the word we get after affix removal (also known as lemma) is a meaningful one. Lemmatization makes sure that lemma is a word with meaning and hence it takes a longer time to execute than stemming.	
39.	Chatbots are a form of artificial intelligence that is programmed to interact with humans in such a way that they sound like humans themselves. Depending on the complexity of the chatbots, they can either just respond to specific keywords or they can even hold full conversations that make it tough to distinguish them from humans. Chatbots are created using Natural Language Processing and Machine Learning, which means that they understand the complexities of the English language. a. NLP is used in search engines they suggest the text to be typed automatically b. Siri, Alexa, or Google Assistant uses NLP. They use a complex combination of speech recognition, natural language understanding, and natural language processing to understand what humans are saying and then act on it. c. Language Translator - Google Translate and other translation tools as well as use Sequence to sequence modelling that is a technique in Natural Language Processing. It allows the algorithm to convert a sequence of words from one language to another which is translation. d. Sentiment Analysis - companies can use sentiment analysis to understand how a particular type of user feels about a particular topic, product, etc. They can use natural language processing, computational linguistics, text analysis, etc. to understand the general sentiment of the users for their products and services and find out if the sentiment is good, bad, or neutral e. Grammar Checkers - They use not only correct grammar and check spellings but also suggest better synonyms and improve the overall readability of your content. The NLP algorithm is trained on millions of sentences to understand the correct format. Some of the most popular grammar checkers that use NLP include Grammarly, WhiteSmoke, ProWritingAid, etc.	4

40.		**Human language**	**Computer Language**		4
		Human language is made up of letters, words and sentences depending on the languages.	Machine/computer understands the language of numbers (binary numbers- 0'sand 1's). Everything that is sent to the machine has to be converted to numbers.		
		It is very easy for humans to process andcommunicate in natural languages like English, Hindi etc.	For machines understanding and generatingnatural languages is very complex process.		
		Our brain keeps on processing the sounds that it hears around itself and tries to make sense out of them all the time.	Computer uses NLP techniques like Text Normalisation, Bag of words to convert the text to numbers for it to process.		

UNIT-7: EVALUATION



Problem Scoping ----- > Data Acquisition ---- > Data Exploring ------ > Modelling > Evaluation.

Evaluation is the final stage in AI Project Cycle. Once a model has been made and trained, it needs to go through proper testing so that one can calculate the *efficiency* and *performance* of the model. Hence, the model is tested with the help of Testing Data.

Evaluation is the process of understanding the reliability and final performance of any AI model by giving the test data set into the model and comparing it`s output with actual answers.

Why do we need evaluation?

While in modelling, we make different types of models. Then a decision to be taken which model is better than another. So, for that proper testing and evaluation is needed to calculate the efficiency and performance of a model.

An efficient evaluation model proves helpful in selecting the most suitable modelling method thatwould represent our data.

We must keep in mind that it is not advisable to use the data that we used to create the model to evaluate it. Why?

Ans-Training data must not be used for evaluation purposes because a model simply remembers the whole of training data, therefore always predicts the correct output for any point in the training set whenever training data is fed again. But it gives very wrong answers if a new dataset is introduced to the model. This situation is known as *overfitting*.

Evaluation is basically done by two things:

1. Prediction The output given by the machine after training and testing the data is known asPrediction. (Output of the machine)

2. Reality Reality is the real situation and real scenario where prediction has been made by the machine. (Reality or truth)

We will consider many scenarios for evaluation. Then *what is Scenario?*

Consider an AI based prediction model which is deployed to identify Football or a soccer ball. Objective is to find out whether the given image is a football. Now there exists two conditions asdiscussed above-

Prediction- output given by the machine

Reality- real scenario about image shown when prediction is done. There are various combination based on these two conditions:

1. Case 1

Is this a Football?

1. Prediction = YES
2. Reality = YES
3. True Positive

Here, we can see in the picture that it's a football. The model's prediction is Yes which means it's football. The Prediction matches Reality. Hence, this condition is termed as True Positive.

2. Case 2

Is this a Football?

1. Prediction = **NO**
2. Reality = **NO**
3. **True Negative**

Here this is Not an image of Football hence the reality is No. In this case, the machine has predicted it correctly as a No. Therefore, this condition is termed **as** True Negative**.**

3. Case 3

Is this a Football?

1. Prediction = **YES**
2. Reality = **NO**
3. **False Positive (Type 1 Error)**

Here the reality is that it is not Football. But the machine has incorrectly predicted that this is Football. This case is termed False Positive.

Another example- You predicted that India won the cricket match series against England but theylost.

4.Case 4

Is this a Football?

1. Prediction = **NO**
2. Reality = **YES**
3. **False Negative (Type 2 Error)**

Here, a Football has been in a different look because of which the Reality is Yes but the machine has incorrectly predicted it as a No which means the machine predicts that it is not Football. Therefore, this case becomes False Negative.
Now these combinations are done by using different metrics. One of them is the Confusion Matrix.

Confusion Matrix-

1. The comparison between the results of Prediction and reality is called the Confusion Matrix.
2. It is a record that helps in evaluation.
3. It is not a calculation; it is a performance measurement for machine learning classificationproblems where output can be two or more classes.

Now again consider the example of football:

Result of comparison between prediction and reality can be recorded in a confusion matrix.

Parameters to evaluate the Model-

There are four methods to evaluate the model.

1) Accuracy- It is the percentage of correct predictions out of all the observations.

A prediction is correct if it matches the reality.

All True positive and True Negative are the cases in which the Prediction matches with reality.

Accuracy Formula

OR

Here Total cases/observations=

TP+TN+FP+FNEXAMPLE-

Let us again take the football example.
Assume that the model always predicts that object is not football. But in reality, there is 5% chances of object being a football. In this case, for 95 cases, the model will be right but for 5 cases in which the object was a football, the model predicted it to be not a football. Here,

1. True Positives = 0
2. True Negatives = 95
3. Total cases = 100
4. Therefore, accuracy becomes:95+0/100 = 95%

2. Precision Parameter-

It is defined as the percentage of true positive cases versus all the cases where the prediction is true. It takes True Positives and False Positives.

Going back to the football example, in this case, assume that the model always predicts that object is a Football irrespective of the reality. In this case, all the Positive conditions would be considered that is,

- True Positive (Prediction = Yes and Reality = Yes)
- False Positive (Prediction = Yes and Reality = No)

In this case, the Players will check for the ball all the time to see if it is Football or not (which means if the reality is True or False).

If Precision is high, this means the True Positive cases are more, giving lesser False predictions.

3. Recall Parameter

It is the fraction of positive cases that are correctly identified. It considers the true reality cases where in Reality, there was a football but the machine either detected it correctly or didn`t. That is, it considers True Positive (There was a football in reality and the model predicted a football) and False Negative (object is a football and model predicts it is not).

$$\text{Recall} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}} \qquad \text{Recall} = \frac{TP}{TP + FN}$$

We can see that the Numerator in both Precsion and Recall is same; True Positive. But in the denominator, Precision counts the False Positive while Recall takes False Negative into consideration.

Which one is more important than another, Precision or Recall?

1. Choosing between Precision and Recall depends on the condition in which the model has been deployed. In a case like Forest Fire, a False Negative can cost us a lot and is risky too. Imagine no alert being given even when there is a Forest Fire. The whole forest might burn down.

2. Another case where a False Negative can be dangerous is Viral Outbreak. Imagine a deadly virus has started spreading and the model which is supposed to predict a viral outbreak does not detect it. The virus might spread widely and infect a lot of people.

3. On the other hand, there can be cases in which the False Positive condition costs us more than False Negatives. One such case is Mining. Imagine a model telling you that there exists treasure at a point and you keep on digging there but it turns out that it is a false alarm. Here, the False Positive case (predicting there is a treasure but there is no treasure) can be very costly

.

4. Consider a model that predicts whether a mail is spam or not. If the model always predicts that the mail is spam, people would not look at it and eventually might lose important information. Here also False Positive condition (Predicting the mail as spam while the mail is not spam) would have a high cost.

- If we want to know if our model`s performance is good, we need these two measures: Precision and Recall. For some cases, you might have High precision but Low Recall or Low Precision but High Recall. But since both the measures are important, there is a need for a parameter which takes both Precision and Recall into account.

4. F1 Score

It can be defined as the measure of balance between precision and recall.

An ideal situation is there when we have a value of 1 for both Precision and Recall. Then F1 score would also be 1(100%). It is known as the perfect value for F1 Score. A model is having a good performance if F1 Score is high.

Precision	Recall	F1 Score
Low	Low	Low
Low	High	Low
High	Low	Low
High	High	High

1 Mark question	
1	The process of understanding the reliability of any AI model based on output by feeding the test dataset is a. Data feed b. Data Reliability c. Model Evaluation d. None of these
2	The percentage of true positive cases versus all the cases where the prediction is true is defined as a. Precision b. Accuracy c. F1 Score d. None of these
3	The percentage of correct predictions out of all observations. a. Prediction b. Accuracy c. F1 Score d. None of these
4	The result of comparison between the prediction and reality is recorded in a. F1 Score b. Confusion matrix c. Evaluation Model d. All of these
5	The measure of balance between precision and recall. a. Accuracy b. F1 Score c. Precision d. None of these
6	Which of the following talks about how true the predictions are by any model? a. Accuracy b. Reliability c. Recall d. F1 Score
7	Which of the following parameters will be consider by recall, while evaluating a model`s performance? i. False negative ii. True negative iii. False positive iv. True Positive Choose the correct option: a. only (i) b. (ii) and (iii) c. (iii) and (iv) d. (i) and (iv)

8	The output given by the AI machine is known as _____ a. Prediction b. Reality
9	Which of the following statements is not true about overfitting models? (a) This model learns the pattern and noise in the data to such extent that it harms the performance of the model on the new dataset (b) Training result is very good and the test result is poor (c) It interprets noise as patterns in the data (d) The training accuracy and test accuracy both are low
10	Seema is learning the conditions that make up the confusion matrix. She came across a scenario in which the machine that was supposed to predict a bird was always predicting a bird. What is this condition called? a. False Positive b. True Positive c. False Negative d. True Negative
11	What is the value of F1 score if the model is 100 % accuracy? a. 100 b. 1 c. 0 d. 50
12	When the prediction is True and reality is False, that condition is termed as a. TN b. TF c. FP d. FN
13	Out of the following, which evaluation methods are used to calculate F1 score? a. Accuracy & recall b. Precision & F1 score c. Accuracy and Precision d. Precision & Recall
14	The F1 score ranges from _____to _____
15	Recall method is not depend on True negative. (True/False)
16	Arun was confused with the terms used in the evaluation stage. Suggest her the term used for the percentage of correct predictions out of all the observations. (a) Accuracy (b) Precision (c) Recall (d) F1 Score

17	In spam email detection, which of the following will be considered as " False negative" ? a. When a spam email is mistakenly identified as legitimate. b. When an email is accurately recognised as spam. c. When an email is inaccurately labelled as important. d. When a legitimate email is accurately identified as not spam.
18	When the prediction is False and reality is True, that condition is called…….. a. TN b. TF c. FP d. FN
19	Statement 1: F1 score is evaluated based on precision or recall. Statement 2: When the F1 score is 0, the model accuracy is 100% a. Both statement1 and statement 2 are correct. b. Both statement1 and statement 2 are incorrect. c. Statement 1 is correct but statement 2 is incorrect. d. Statement 1 is incorrect but statement 2 is correct.
20	The final step in AI project cycle is…….
2-mark questions	
1	What is evaluation of an AI model?
2	Define confusion matrix?
3	Explain the concept of overfitting with respect to AI model evaluation.
4	Explain accuracy of an AI model? How do you calculate accuracy?
5	Explain recall of an AI model with formula.
6	Explain precision of an AI model? Write the formula.
7	Define F1 score with formula.
8	Explain the condition TP.
9	Explain the condition TN .
10	What is the need of AI model evaluation?
11	Give the possible reasons for an AI model not being efficient?
12	Define the term prediction and reality.
13	Consider the data given below based on AI prediction model, TP=50, TN=40,FN=60, FP=50. Calculate the total number of tests have been performed according to the data given.

14

According to the data given below, Calculate TP,TN,FP,&FN.

Index	1	2	3	4	5	6	7	8	9	10
Actual	Bird	Bird	Bird	Not bird	Not Bird	Bird	Not bird	Bird	Not bird	Bird
Predicted	Bird	Bird	Not Bird	Bird	Not Bird	Bird	Bird	Not bird	bird	Not bird

15

Consider the confusion matrix and calculate the recall and precision.

Confusion matrix		Reality	
		YES	NO
prediction	YES	40	60
	NO	80	20

4 mark question

1 Explain the different methods of evaluation of AI models.

2

Consider the scenario where the AI model is created to predict if there will be rain or not. The confusion matrix for the same is given below. Calculate precision, accuracy and recall.

Confusion matrix		Reality	
		YES	NO
prediction	YES	70	30
	NO	50	50

3

A binary classification model has been developed to classify the information spread through social media is as either “Fake ” or “Real ”. The model was tested on a dataset of 300 information, and the resulting confusion matrix is as follows:

Confusion matrix		Reality	
		YES	NO
prediction	YES	150	40
	NO	50	60

calculate Accuracy, precision, recall and F1 score.

4

The country was shaken up by a series of flood which has done a huge damage to the people as well as the infrastructure. To address this issue, an AI model has been created which can predict if there is a chance of a flood or not. The confusion matrix for the same is as below: calculate Accuracy, precision, recall and F1 score.

Confusion matrix		Reality	
		YES	NO
prediction	YES	90	10
	NO	10	50

5	An IT company situated in Bombay developed an AI model which predicts the purchasing of electronic gadgets. During testing, the AI model came up with the following predictions. Based on the given predictions, calculate the following

Confusion matrix		Reality	
		YES	NO
prediction	YES	60	25
	NO	5	10

i. How many total tests have been performed in the above scenario.
ii. Calculate precision, recall and F1 score.

ANSWERS

1 mark questions	
1	Model Evaluation
2	Precision
3	Accuracy
4	Confusion matrix
5	F1 score
6	Accuracy
7	d (I &iv)
8	Prediction
9	Training result is very good and the test result is poor
10	False Negative
11	1
12	TN
13	Precision & Recall
14	0 to 1
15	True
16	Accuracy
17	When a spam email is mistakenly identified as legitimate.
18	FN
19	Statement 1 is correct but statement 2 is incorrect.
20	Model Evaluation
2-mark question	
1	Evaluation is the process of understanding the reliability of any AI model, based on outputs by feeding test dataset into the model and comparing with actual answers
2	Confusion matrix is a table that shows the result of comparison between the prediction and reality. The confusion matrix allows us to understand the prediction results.

<table>
<tr><td></td><td></td><td colspan="2" rowspan="2">Confusion matrix</td><td colspan="2">Reality</td></tr>
<tr><td></td><td></td><td>YES</td><td>NO</td></tr>
<tr><td></td><td></td><td rowspan="2">prediction</td><td>YES</td><td>TP</td><td>FP</td></tr>
<tr><td></td><td></td><td></td><td>NO</td><td>FN</td><td>TN</td></tr>
<tr><td>3</td><td colspan="5">Overfitting is a problem where the evaluation of machine learning algorithms on training data is different from unseen data.</td></tr>
<tr><td>4</td><td colspan="5">Accuracy is defined as the percentage of correct predictions out of all the observations. A prediction can be said to be correct if it matches the reality.
$Accuracy = \frac{(TP+TN)}{TP+TN+FP+FN} * 100\%$</td></tr>
<tr><td>5</td><td colspan="5">Recall is defined as the fraction of positive cases that are correctly identified.
$Recall = \frac{TP}{TP+FN} * 100$</td></tr>
<tr><td>6</td><td colspan="5">Precision is defined as the percentage of true positive cases versus all the cases where the prediction is true.
$Precision = \frac{TP}{TP+FP} * 100$</td></tr>
<tr><td>7</td><td colspan="5">F1 score is defined as the measure of balance between precision and recall.
$F1\ score = 2 * \frac{Precision * Recall}{Precision + Recall}$</td></tr>
<tr><td>8</td><td colspan="5">TP stands for True Positive. When the Prediction matches with the Reality, that condition is called TP. That is, prediction is True and the Reality is True.</td></tr>
<tr><td>9</td><td colspan="5">TN stands for True Negative. When the model evaluate that the prediction is False and the Reality is also False.</td></tr>
<tr><td>10</td><td colspan="5">The primary purpose of evaluation in the AI project cycle is to check the reliability of the AI model. It helps determine if the model is performing as expected and if it can make accurate predictions or classifications based on the test dataset.</td></tr>
<tr><td>11</td><td colspan="5">• Lack of Training Data
• Unauthenticated Data / Wrong Data
• Inefficient coding / Wrong Algorithms</td></tr>
<tr><td>12</td><td colspan="5">• Prediction is the output which is given by the machine
• Reality is the real situation and real scenario where prediction has been made by the machine.</td></tr>
<tr><td>13</td><td colspan="5">Total no of tests performed=TP+TN+FP+FN
=50+40+60+50=200</td></tr>
<tr><td>14</td><td colspan="5">TP=3
TN=1
FP=3
FN=3</td></tr>
</table>

15	$Recall = \frac{TP}{TP + FN} * 100$ $=\frac{40}{40+80} * 100 = 75$ $Precision = \frac{TP}{TP + FP} * 100$ $= \frac{40}{40 + 60} * 100 = 40$
4 mark question	
1	Accuracy is defined as the percentage of correct predictions out of all the observations. A prediction can be said to be correct if it matches the reality. $Accuracy = \frac{(TP+TN)}{TP+TN+FP+FN} * 100\%$ Recall is defined as the fraction of positive cases that are correctly identified. $Recall = \frac{TP}{TP + FN} * 100$ Precision is defined as the percentage of true positive cases versus all the cases where the prediction is true. $Precision = \frac{TP}{TP + FP} * 100$ F1 score is defined as the measure of balance between precision and recall. $F1\ score = 2 * \frac{Precision * Recall}{Precision + Recall}$
2	Accuracy =(70+50)/200=0.60 Recall=70/120=0.58 Precision=70/100=0.7 F1 Score=2*(.58*0.70)/0.58+0.70=0.639
3	Accuracy=(150+60)/300=0.7 Recall=150/200=0.75 Precision=150/190=0.789 F1 score=2*0.75*0.789/(0.75+0.789)=0.76
4	Accuracy=(90+50)/160=0.875 Recall=90/100=0.9 Precision=90/100=0.9 F=2*recall*precision/(recall+precision) =2*0.81/1.8=0.9
5	Precision = True Positives / (True Positives + False Positives) = 60 / (60 + 5) = 0.923 Recall = True Positives / (True Positives + False Negatives) = 60 / (60 + 25) = 0.706 F1 Score = 2 * (Precision * Recall) / (Precision + Recall) = 2 * (0.923 * 0.706) / (0.923 + 0.706) ≈ 0.801 (ii) Total tests performed = Sum of all entries in the confusion matrix = 60 + 25 + 5 + 10 = 100

ARTIFICIAL INTELLIGENCE (417) SUGGESTED PRACTICAL LIST 2024-25

Activity 1: **Write a Python code to calculate Simple Interest if the principle_amount = 2000 rate_of_interest = 8 time = 10**

```
P=2000
T=10
R=8
SI=(P*T*R)/100
print("Simple Interest is",SI)
```

o/p:

Simple Interest is 1600.0

Activity 2: **Write a Python code to calculate Area of a triangle with Base and Height**

```
B=int(input("Enter Base of a rectangle"))
H=int(input("Enter Height of a rectangle"))
print("Area of a rectangle is",0.5*B*H)
```

o/p:

Enter Base of a rectangle5

Enter Height of a rectangle4

Area of a rectangle is 10.0

Activity 3: **Write a Python code to check whether a person is eligible to vote or not.**

```
Age=int(input("Enter person's age"))
if Age>=18:
    print("Person is Eligible to vote")
else:
    print("Person is not Eligible to vote")
```

o/p:

Enter person's age 21

Person is Eligible to vote

Activity 4**: Write a Python code to print sum of first 10 natural numbers**

```
S=0
for i in range(1,11):
        S=S+i
print("Sum of first 10 natural numbers is",S)
```

o/p:

Sum of first 10 natural numbers is 55

Activity 5**: Write a program to create a list and display list elements.**

```
l=[]
n=int(input("Enter length of the list"))
for i in range(n):
        a=eval(input("Enter list element"))
        l.append(a)
print("Created list is",l)
```

o/p:

Enter length of the list5

Enter list element10

Enter list element20.5

Enter list element45

Enter list element78

Enter list element23

Created list is [10, 20.5, 45, 78, 23]

Activity 6**: Write a program to add the elements of the two lists.**

```
l1=[20,30,40]
l2=[30,50,10]
l3=l1+l2
print("Addition of",l1,"and",l2,"is",l3)
```

o/p:

Addition of [20, 30, 40] and [30, 50, 10] is [20, 30, 40, 30, 50, 10]

Activity 7**: Write a program to calculate mean, median and mode using Numpy**

```
import numpy as np
import statistics as st
l=[30,20,50,60,20]
l1=np.array(l)
print("Mean of",l1,"is",st.mean(l1))
print("Median of",l1,"is",st.median(l1))
print("Mode of",l1,"is",st.mode(l1))
```

o/p:

Mean of [30 20 50 60 20] is 36

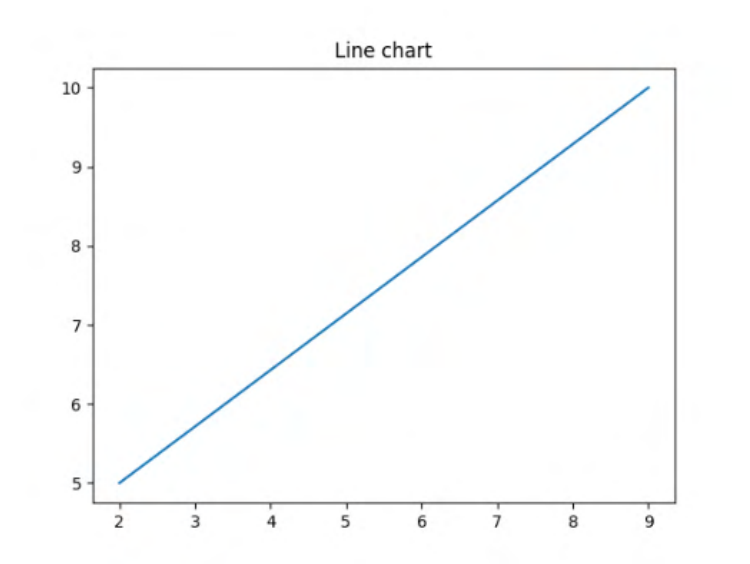
Median of [30 20 50 60 20] is 30

Mode of [30 20 50 60 20] is 20

Activity 8**: Write a program to display line chart from (2,5) to (9,10).**

```
import matplotlib.pyplot as plt
x=(2,9)
y=(5,10)
plt.plot(x,y)
plt.title("Line chart")
plt.show()
```

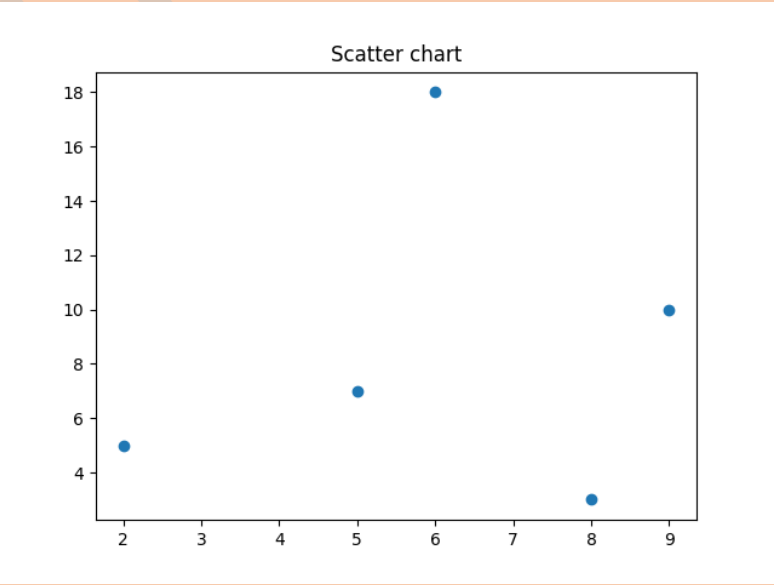
o/p:



Activity 9: **Write a program to display a scatter chart for the following points (2,5), (9,10),(8,3),(5,7),(6,18).**

```
import matplotlib.pyplot as plt
x=[2,9,8,5,6]
y=[5,10,3,7,18]
plt.scatter(x,y)
plt.title("Line chart")
plt.show()
```

o/p:



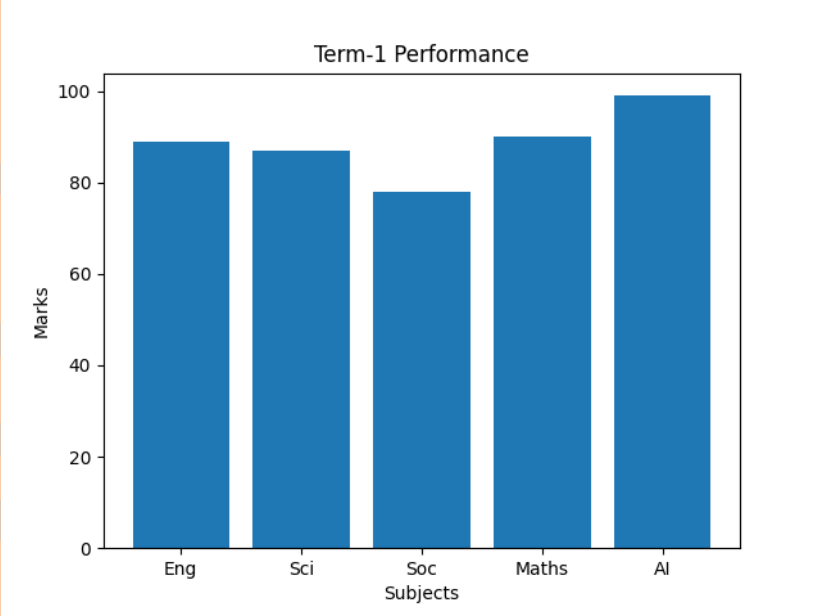
Activity 10: **Write a program to display bar chart for the following data with appropriate titles:**

Subjects=[“Eng”,”Sci”,”Soc”,”Maths”,”AI”]

Marks=[89,87,78,90,99]

```
import matplotlib.pyplot as plt
Sub=["Eng","Sci","Soc","Maths","AI"]
Marks=[89,87,78,90,99]
plt.bar(Sub,Marks)
plt.title("Term-1 Performance")
plt.xlabel("Subjects")
plt.ylabel("Marks")
plt.show()
```

0/p:



Activity 11: **Read CSV file saved in your system and display 5 rows**

```
import pandas as pd
df=pd.read_csv(r"C:\Users\ADMIN\Desktop\abc.csv",nrows=10)
print(df)
```

o/p:

```
RNO     NAME  MARKS
0   1    HARI       67
1   2   RAMESH    89
2   3   SOMESH    56
3   4   RAJESH     78
4   5  BHIMESH    45
```

Activity 12: **Read CSV file saved in your system and display its information**

```
import pandas as pd
df=pd.read_csv(r"C:\Users\ADMIN\Desktop\abc.csv",nrows=10)
print(df)
```

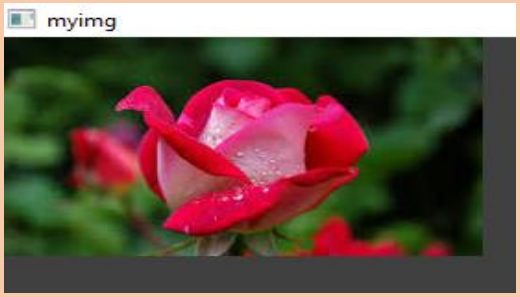
o/p:

```
RNO     NAME  MARKS
0   1    HARI       67
1   2   RAMESH    89
2   3   SOMESH    56
3   4   RAJESH     78
4   5  BHIMESH    45
5   6  SRIKANTH    67
6   7  SRINIVAS    89
7   8  SANDHYA    90
8   9   SADANA     56
9  10     RAJU      45
```

Activity 13**: Write a program to read an image and display using Python**

```
import cv2
img=cv2.imread("abc.jpg")
cv2.imshow('Image',img)
cv2.waitKey(0)
```

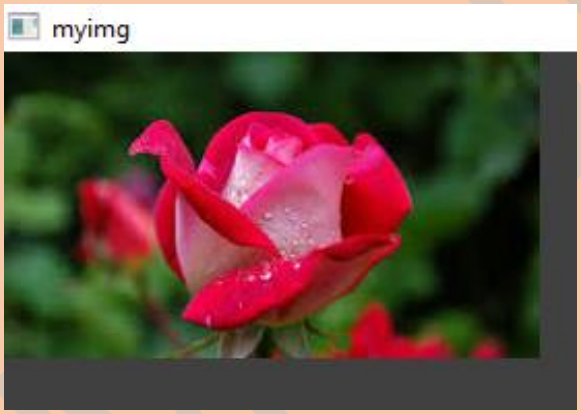
o/p:



Activity 14**: Write a program to read an image and display image shape and size using Python**

```
import cv2
img=cv2.imread(r"C:\Users\ADMIN\Desktop\abc.jpg")
cv2.imshow('myimg',img)
print("The shape of the image is",img.shape)
print("The Size of the image is",img.size)
cv2.waitKey(0)
```

o/p:



The shape of the image is (148, 259, 3)

The Size of the image is 114996

ARTIFICIAL INTELLIGENCE (SUBJECT CODE - 417)

Sample Question Paper for Class X (Session 2024-2025)

Max. Time: 2 Hours **Max. Marks: 50**

General Instructions:

1. Please read the instructions carefully.
2. This Question Paper consists of 21 questions in two sections: Section A & Section B
3. Section A has Objective type questions whereas Section B contains Subjective type questions.
4. Out of the given (5 + 16 =) 21 questions, a candidate has to answer (5 + 10 =) 15 questions in the allotted (maximum) time of 2 hours.
5. All questions of a particular section must be attempted in the correct order.
6. SECTION A - OBJECTIVE TYPE QUESTIONS (24 MARKS): i. This section has 05 questions. ii. Marks allotted are mentioned against each question/part. iii. There is no negative marking.
   iv. Do as per the instructions given.
7. SECTION B – SUBJECTIVE TYPE QUESTIONS (26 MARKS): i. This section has 16 questions. ii. A candidate has to do 10 questions. iii. Do as per the instructions given. iv. Marks allotted are mentioned against each question/part

SECTION A: OBJECTIVE TYPE QUESTION		
Q. 1	**Answer any 4 out of the given 6 questions on Employability Skills**	**1 x 4 = 4**
(i)	What is the primary purpose of active listening in communication? (a) To formulate a response while the other person is speaking (b) To understand the speaker's message fully and accurately (c) To interrupt and ask clarifying questions immediately (d) To dominate the conversation with personal experiences	1
(ii)	Adam is in a meeting where he disagrees with the proposed strategy. How should he communicate his disagreement effectively? (a) Raise his voice to emphasize his point (b) Wait until after the meeting to share his concerns privately (c) Interrupt the speaker to express his disagreement (d) Use diplomatic language and provide constructive feedback during the discussion	1

(iii)	Which of the following is a key aspect of time management? (a) Procrastination and delaying tasks (b) Prioritizing tasks based on urgency and importance (c) Taking on more tasks than can be realistically completed (d) Ignoring deadlines and commitments	1
(iv)	You are training employees on safe computing practices to avoid cyber threats. What steps would you take while using public Wi-Fi networks? (a) Disable firewall protection	1
	(b) Avoid accessing sensitive websites (c) Use a Virtual Private Network (VPN) (d) Share Wi-Fi login credentials with others	
(v)	What is a key characteristic of successful entrepreneurs? (a) Avoiding risks and playing it safe (b) Focusing solely on short-term profits (c) Being adaptable and willing to learn from failures (d) Rejecting new ideas and sticking to traditional methods	1
(vi)	Ecotech Solutions is a company specializing in green technologies. They are planning to expand their operations globally. What strategies can they adopt to ensure their expansion aligns with green principles? (a) Prioritizing cost-cutting measures over environmental concerns (b) Implementing renewable energy sources in their production facilities (c) Disregarding local environmental regulations for faster growth (d) Promoting excessive consumption of their products without considering sustainability	1
Q.2.	**Answer any 5 questions out of 6**	1x5=5
	Fill in the blanks: "Human intelligence encompasses various components such as reasoning, problem-solving, and _____."	1
	Artificial Intelligence (AI) always operates ethically and without bias. - True or False?	1
(iii)	With Great Power Comes Great Responsibility"? List 2 suggestions for responsible use of AI.	1
(iv)	Which of the following statements about AI bias are incorrect? a) AI bias can result from biased training data. b) AI systems are inherently unbiased. c) Addressing AI bias requires diverse and inclusive data. d) Regular monitoring and auditing can help mitigate AI bias.	1

	How can AI be used in real life? a) Autonomous driving vehicles b) Personalized medicine c) Predicting future stock prices d) All of the above	1
(vi)	What are some ethical concerns involved in AI development? a) AI bias b) Data privacy c) Unemployment due to automation d) Transparency in decision-making	1
Q3	**Answer any 5 out of the given 6 questions**	**1 x 5 = 5**
(i)	What is the first step in the AI project cycle? (a) Model training (b) Data collection and preprocessing (c) Model deployment (d) Evaluation and testing	1
(ii)	Which technique is commonly used in data science to handle missing data in a dataset? (a) Ignoring the missing values (b) Filling missing values with the mean or median (c) Dropping rows with missing values (d) Creating synthetic data to replace missing values	1
(iii)	What is the primary application of object detection in computer vision? (a) Classifying images into categories (b) Segmenting images into regions (c) Identifying and locating objects within an image (d) Generating captions for images	1
(iv)	Which task in natural language processing involves predicting the next word in a sequence of words? (a) Named Entity Recognition (NER) (b) Sentiment Analysis (c) Part-of-Speech Tagging (POS) (d) Language Modeling	1
(v)	What is the purpose of model evaluation in machine learning? (a) To train the model on new data (b) To select the best model based on performance metrics (c) To preprocess the data before training (d) To collect data for future analysis	1
(vi)	The total number of Sustainable Development Goals (SDGs) were launched at the United Nations Sustainable Development Summit in New York in the year 2015, forming the 2030 Agenda for Sustainable Development are: a) 17 b)15 c)13 d)1	1

Q 4.	**Answer any 5 out of the given 6 questions**	1X5 =5
(i)	Which of the following includes major tasks of NLP? a) Automatic Summarization b) Discourse Analysis c) Machine Translation d) All of the mentioned	1
(ii)	Which NLP task involves determining the sentiment or emotional tone expressed in a piece of text such as positive, negative, or neutral? a) Named entity recognition b) Sentiment analysis c) Part of speech tagging d) Machine translation	1
(iii)	Rock, Papers, and Scissors game is based on the following domain. a) Data for AI b) Natural Language Processing c) Computer Vision d) Image Processing	1
(iv)	The_____makes the data understandable for humans as we can discover trends and patterns out of it. a) Random Data b) Graphical Representation c) Unstructured Data d) None of the above	1
(v)	In unsupervised learning model, if we need to reduce their dimension, which algorithm do we have to use? a) Supervised algorithm b) Dimensionality reduction algorithm c) Clustering algorithm d) None of the above	1
(vi)	Chatbots often use a specific type of NLP model to maintain the context of a conversation. What is the name of this model? a) Recurrent Neural Network (RNN) b) Convolutional Neural Network (CNN) c) Transformer Model d) Decision Tree Classifier	1
Q5	**Answer any 5 out of the given 6**	1x5= 5
(i)	What is the primary purpose of a confusion matrix in model evaluation? a) To compare different machine learning algorithms b.) To visualize the model's decision boundary c) To measure model's prediction accuracy d) To evaluate the performance of classification model	1

(ii)	Each evaluation metric represents the ratio of true negatives to all actual negative instances and is commonly used in binary classification. a)Accuracy b)Precision c)Recall d)Specify	1
(iii)	In model evaluation, what is the term for the process of splitting the data set into two parts? One for training and one for testing. a). Data sampling. b). Data cleaning. c). Data splitting. d). Data transformation.	1
(iv)	If evaluation model will simply remember the whole training set, and will therefore always predict the correct label for any point in the training set. This is known as : a) Overfitting b) Overriding c) Over remembering d) None of the above	1
(v)	The percentage of true positive cases versus all the cases where the prediction is true is called A. Overfitting B. Accuracy C. Precision D. Data Acquisition	1
(vi)	Rhea wants to know what is the primary purpose of validation data set in machine learning. It is: A. To train the model. B. To evaluate the model on unseen data. C. To test the model's performance on the training data. D. To visualize data relationships.	1
SECTION B: SUBJECTIVE TYPE QUESTIONS		
Answer any 3 out of the given 5 questions on Employability Skills **Answer each question in 20 – 30 words.** **2 x 3 = 6**		
Q 6.	How can AI-powered chatbots be utilized to enhance customer service in a retail business? Provide specific examples of how such technology can improve communication with customers and resolve common queries.	2

Q 7.	As a student managing multiple assignments and deadlines. How could you use AI tools or apps to organize your tasks, set priorities, and ensure timely completion of each assignment? Provide 2 AI-based strategies for effective self-management.	2
Q 8.	How can AI-based recommendation systems enhance the user experience on e-commerce platforms? Provide an example of how these systems work.	2
Q 9.	Discuss the role of AI in improving agricultural practices to reduce water usage and increase crop yield.	2
Q 10.	Mention precautions to take to do secure online payments	2
Answer any 4 out of the given 6 questions in 20 – 30 words each (2 x 4 = 8 marks)		
Q 11.	Compare and contrast the approaches of symbolic AI and machine learning in solving AI tasks, highlighting their strengths and limitations.	2
Q 12.	Evaluate the role of continuous testing and validation throughout the AI project cycle in ensuring the reliability and accuracy of AI models.	2
Q 13.	Explain the impact of data quality on the outcomes of data science projects, considering factors such as data completeness, accuracy, and relevance	2
Q 14.	What are the ethical considerations related to the use of facial recognition technology in public spaces, discussing privacy concerns and potential biases.	2
Q 15.	What are NLP systems with machine learning-based approaches, highlighting their applicability in different NLP tasks.	2
Q 16.	Evaluate the effectiveness of different evaluation metrics, such as precision, recall, and F1 score, in assessing the performance of AI models across various tasks.	2
Answer any 3 out of the given 5 questions in 50– 80 words each 4 x 3 = 12		
Q 17.	Aaadya is multi-talented and has excelled in academics, music, dancing, sports and painting. Describe different types of intelligences by naming and explaining any four types of intelligences?	4
Q 18.	After class 12 Rahul wanted to join for AI course. His parents didn't know much about its domains Explain them the domains of AI.	4
Q 19.	You're explaining neural networks to your classmate Varun in a class 10 AI lesson. How would you describe the basic structure and functioning of a neural network using a simple example? Also, mention one real-world application of neural networks that you find interesting and explain how neural networks are beneficial in that context.	4

<table>
<tr><td>Q 20.</td><td>Normalise the text on the segmented sentences given below:
Document 1: Diya and Riya are best friends.
Document 2: Diya likes to play guitar but Riya prefers to play violin</td><td>4</td></tr>
<tr><td>Q 21.</td><td>A social media company has developed an AI model to predict which users are likely to churn (cancel their account). During testing, the AI model came up with the following predictions.
<table>
<tr><td colspan="2">Confusion Matrix</td><td colspan="2">Reality</td></tr>
<tr><td colspan="2"></td><td>yes</td><td>no</td></tr>
<tr><td rowspan="2">Predicted</td><td>yes</td><td>60</td><td>25</td></tr>
<tr><td>no</td><td>5</td><td>10</td></tr>
</table>
(i) Calculate precision, recall and F1 Score for churn prediction
(ii) How many total tests were performed in the above scenario?</td><td>4</td></tr>
</table>

ANSWER KEY

Q1	(i) (b) To understand the speaker's message fully and accurately (ii) (d) Use diplomatic language and provide constructive feedback duringthe discussion (iii) (b) Prioritizing tasks based on urgency and importance (iv) (c) Use a Virtual Private Network (VPN) (v) (c) Being adaptable and willing to learn from failures (vi) (b) Implementing renewable energy sources in their productionfacilities	
Q2	(i) creativity (ii) False (iii)(a) Ensure transparency in AI decision-making processes (b) Regularly audit AI systems for bias and fairness (iv) b) AI systems are inherently unbiased. (v) d) All of the above (vi)(a) AI bias(b) Data privacy	
Q3	(ii) (b) Filling missing values with the mean or median (iii) (c) Identifying and locating objects within an image (iv) (d) Language Modeling (v) (b) To select the best model based on performance metrics (vi) (a) 17	
Q4	(i) d) All of the mentioned (ii) b) Sentiment analysis (iii) d) Image Processing (iv) b) Graphical Representation (v) b) Dimensionality reduction algorithm	
Q5	(i) d) To evaluate the performance of classification model (ii) c) Recall (iii) c) Data splitting (iv) a) Overfitting (v) C. Precision (vi) B. To evaluate the model on unseen data.	
Q6	AI-powered chatbots can enhance customer service in retail by providing immediate assistance, answering frequently asked questions, and guiding customers through the purchasing process. For example, a chatbot can help customers track their orders, recommend products based on their preferences, and resolve billing inquiries in real-time.	
Q7	As a student, AI tools can help organize tasks and set priorities by using task management apps that utilize AI algorithms to schedule assignments based on deadlines and workload. Additionally, AI-powered virtual assistants can provide reminders and suggestions for effective time management.	

Q8	AI-based recommendation systems enhance user experience on e-commerce platforms by analyzing user preferences and behavior to provide personalized product recommendations. For instance, platforms like Amazon use collaborative filtering algorithms to suggest products based on past purchases, browsing history, and similar users' preferences.	
Q9	AI plays a crucial role in improving agricultural practices by analyzing data from sensors, drones, and satellites to optimize water usage, detect crop diseases	
	early, and forecast yield. AI algorithms can provide insights on when and where to irrigate, identify areas needing pest control, and suggest crop varieties suited to specific conditions.	
Q10	Precautions for secure online payments include using trusted payment gateways, ensuring the website has SSL encryption, avoiding public Wi-Fi for transactions, regularly monitoring bank statements, and enabling two-factor authentication where possible. Additionally, using virtual cards or digital wallets can add an extra layer of security.	
Q11	Symbolic AI relies on predefined rules and representations to solve AI tasks, while machine learning learns patterns from data. Symbolic AI is transparent and interpretable but may struggle with complex or ambiguous tasks. Machine learning, on the other hand, can handle large datasets and adapt to new information but may lack transparency and require substantial computational resources for training.	
Q12	Continuous testing and validation throughout the AI project cycle ensure the reliability and accuracy of AI models by detecting and correcting errors early. It helps in refining models, improving performance, and ensuring that they meet the desired objectives and specifications.	
Q13	Data quality significantly impacts the outcomes of data science projects. Factors such as data completeness, accuracy, and relevance influence the reliability and effectiveness of analyses and models. Poor data quality can lead to biased results, erroneous insights, and ineffective decision-making.	
Q14	Facial recognition technology in public spaces raises ethical concerns regarding privacy invasion and potential biases. There are concerns about surveillance, consent, and the misuse of facial data. Biases in facial recognition algorithms can lead to discriminatory outcomes, particularly against certain demographics.	
Q15	NLP systems with machine learning-based approaches utilize algorithms to learn patterns from textual data, enabling tasks such as sentiment analysis, named entity recognition, and machine translation. These systems excel in handling large and diverse datasets, offering scalability and adaptability across various NLP tasks.	

Q16	Types of Intelligences: Linguistic Intelligence: Aaadya's ability to excel in academics and possibly writing or public speaking showcases linguistic intelligence, which involves proficiency in language and communication. Musical Intelligence: Aaadya's talent in music indicates musical intelligence, which involves sensitivity to rhythm, melody, and sound. Bodily-Kinesthetic Intelligence: Aaadya's prowess in dancing and sports suggests bodily-kinesthetic intelligence, which relates to physical coordination, agility, and control. Visual-Spatial Intelligence: Aaadya's skill in painting reflects visual-spatial intelligence, which involves the ability to perceive the world accurately and manipulate objects mentally	
Q17	Types of Intelligences: Linguistic Intelligence: Aaadya's ability to excel in academics and possibly writing or public speaking showcases linguistic intelligence, which involves proficiency in language and communication. Musical Intelligence: Aaadya's talent in music indicates musical intelligence, which involves sensitivity to rhythm, melody, and sound. Bodily-Kinesthetic Intelligence: Aaadya's prowess in dancing and sports suggests bodily-kinesthetic intelligence, which relates to physical coordination, agility, and control. Visual-Spatial Intelligence: Aaadya's skill in painting reflects visual-spatial intelligence, which involves the ability to perceive the world accurately and manipulate objects mentally.	
Q18	Domains of AI: Machine Learning: It involves algorithms that enable computers to learn from data and make predictions or decisions. Natural Language Processing (NLP): It focuses on enabling computers to understand, interpret, and generate human language. Computer Vision: This domain enables computers to interpret and analyze visual information from the real world, such as images or videos. Robotics: It involves the design and creation of robots capable of performing tasks autonomously or with human assistance.	
Q19	Neural networks can be explained as a computational model inspired by the human brain's structure and functioning. They consist of interconnected nodes or neurons organized in layers. Each neuron receives input, processes it, and sends output to other neurons. By adjusting the connections between neurons, neural networks can learn and perform tasks such as classification or prediction. For example, in image recognition, a neural network analyzes pixel values to identify objects in images.	

Q20	Hint -Stopwords in the given sentence which should not be removed are: @, . (fullstop) ,_(underscore) , 123(numbers) These tokens are generally considered as stopwords, but in the above sentence, these tokens are part of email id. removing these tokens may lead to invalid website address and email ID. So these words should not be removed from the above sentence. (1 mark for identifying any two stop words from the above, and 1 mark for the valid justification.	
	Precision = True Positives / (True Positives + False Positives) = 60 / (60 + 5) = 0.923 Recall = True Positives / (True Positives + False Negatives) = 60 / (60 + 25) = 0.706 F1 Score = 2 * (Precision * Recall) / (Precision + Recall) = 2 * (0.923 * 0.706) / (0.923 + 0.706) ≈ 0.801 (ii) Total tests performed = Sum of all entries in the confusion matrix = 60 + 25 + 5 + 10 = 100.	

Series #CDBA

Set-4

प्रश्न-पत्र कोड
Q.P. Code **104**

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें।
Candidates must write the Q.P. Code on the title page of the answer-book.

ARTIFICIAL INTELLIGENCE

निर्धारित समय : 2 घण्टे
Time allowed : 2 hours

अधिकतम अंक : 50
Maximum Marks : 50

नोट	NOTE
(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **11** हैं।	(I) Please check that this question paper contains **11** printed pages.
(II) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **21** प्रश्न हैं।	(II) Please check that this question paper contains **21** questions.
(III) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।	(III) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
(IV) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें।**	(IV) **Please write down the serial number of the question in the answer-book before attempting it.**
(V) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है। प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा। 10.15 बजे से 10.30 बजे तक परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।	(V) 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the candidates will read the question paper only and will not write any answer on the answer-book during this period.

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General Instructions :

(i) *Please read the instructions carefully.*

(ii) *This question paper consists of **21** questions in two sections : Section **A** & Section **B**.*

(iii) *Section **A** has objective type questions whereas Section **B** contains subjective type questions.*

(iv) *Out of the given **(5 + 16 =) 21** questions, a candidate has to answer **(5 + 10 =) 15** questions in the allotted (maximum) time of **2** hours.*

(v) *All questions of a particular section must be attempted in the correct order.*

(vi) ***Section A – Objective type questions (24 marks) :***

(a) *This section has **05** questions.*

(b) *Marks allotted are mentioned against each question/part.*

(c) *There is no negative marking.*

(d) *Do as per the instructions given.*

(vii) ***Section B – Subjective type questions (26 marks) :***

(a) *This section has **16** questions.*

(b) *A candidate has to do **10** questions.*

(c) *Do as per the instructions given.*

(d) *Marks allotted are mentioned against each question/part.*

Section – A
(Objective Type Questions)

1. Answer any **4** out of the given **6** questions : $4 \times 1 = 4$

(i) SMART method can be used to set goals to make you successful in your career and personal life. What does 'A' in SMART stand for ?

(a) Abrupt (b) Accountable
(c) Achievable (d) Admirable

(ii) Which of the following is not a key element of self-management skills ?

(a) Prioritising your work
(b) Not taking feedback
(c) Goal setting
(d) Staying updated about new practices

(iii) Which of the following is a quality of successful entrepreneurs ?

(a) Hard working
(b) Resistance to change
(c) Lazy
(d) Less-confident

(iv) The most important software in any computer is the _____. This is the software that starts working as soon as we switch on a computer.

(a) Web Browsers (b) Operating System
(c) Office Software (d) Designing Software

(v) Which of the following types of communication takes place when one individual addresses a large gathering ?

(a) Written communication
(b) Public communication
(c) Small group communication
(d) Interpersonal communication

(vi) **Assertion (A) :** Organic farming technique is an example of a green skill that is essential for sustainable agriculture.

Reason (R) : Organic farming technique prioritise environment friendly and sustainable practices such as using natural fertilisers, avoiding synthetic pesticides and promoting soil health.

(a) Both (A) and (R) are true and (R) is the correct explanation for (A).

(b) Both (A) and (R) are true and (R) is not the correct explanation of (A).

(c) (A) is true, but (R) is false.

(d) (A) is false, but (R) is true.

2. Answer any **5** out of given **6** questions : $5 \times 1 = 5$

(i) Which of the following contributes to the efficiency of an AI project ?

(a) High Model Complexity

(b) Relevant and Authentic Training Data

(c) Minimal Preprocessing

(d) Limited Hardware Resources

(ii) This real life application of NLP is used to provide an overview of a news item or blog post, while avoiding redundancy from multiple sources and maximising the diversity of content obtained. Which is this application ?

(a) Chatbot (b) Virtual Assistant

(c) Sentiment Analysis (d) Automatic Summarisation

(iii) Which of the following represent a machine that is smart but not considered Artificial Intelligence (AI) enabled ?

(a) A robotic vacuum cleaner that can navigate and clean floors autonomously.

(b) A chatbot that engages in natural language conversations and answers questions.

(c) A smartphone with facial recognition for unlocking the device.

(d) A digital alarm clock that rings at a set time every morning.

(iv) Which of the following words represent an example of a lemma resulting from lemmatisation for "caring" in context to Natural Language Processing (NLP) ?

(a) Care (b) Cared

(c) Cares (d) Car

(v) Intrapersonal Intelligence is a concept that :

(a) Measures an individual's ability to understand others' emotions and feelings.

(b) Assesses one's proficiency in mathematics and logical reasoning.

(c) Describes the level of self-awareness someone has, starting from realizing weaknesses, strengths, to recognizing their own feelings.

(d) Evaluates an individual's spatial navigation and visualisation skills.

(vi) For Data Science, usually the data is collected in the form of tables. These tabular datasets can be stored in different formats. Which of the following formats is not used for storing data in a tabular format ?

(a) CSV (b) Website

(c) SQL (d) Spreadsheet

3. Answer any **5** out of given **6** questions : $5 \times 1 = 5$

(i) _____ is one of the parameter for evaluating a model's performance and is defined as the fraction of positive cases that are correctly identified.

(a) Precision (b) Accuracy

(c) Recall (d) F1

(ii) In the AI project cycle, which of the following represents the correct order of steps ?

(a) Data Exploration, Problem Scoping, Modelling, Evaluation, Data Acquisition.

(b) Problem Scoping, Data Acquisition, Data Exploration, Modelling, Evaluation.

(c) Modelling, Data Acquisition, Evaluation, Problem Scoping, Data Exploration.

(d) Data Acquisition, Data Exploration, Problem Scoping, Modelling, Evaluation.

(iii) _____ is a concept to unify statistics, data analysis, machine learning and their related methods in order to understand and analyse actual phenomena with data.

(a) Computer Vision (b) Natural Language Processing

(c) Data Science (d) Computer Science

(iv) In computer vision which of the following tasks is used for multiple objects ?

(a) Classification (b) Classification + Localisation

(c) Instance Segmentation (d) Localisation

(v) In spam email detection, which of the following will be considered as "False Negative" ?

(a) When a legitimate email is accurately identified as not spam.

(b) When a spam email is mistakenly identified as legitimate.

(c) When an email is accurately recognised as spam.

(d) When an email is inaccurately labelled as important.

(vi) Which of the following applications is not associated with Natural Language Processing (NLP) ?

(a) Sentiment Analysis (b) Speech Recognition

(c) Spam Filtering in emails (d) Stock Market Analysis

4. Answer any **5** out of the given **6** questions : $5 \times 1 = 5$

(i) **Statement 1 :** Confusion matrix is an evaluation metric.

Statement 2 : Confusion Matrix is a record which helps in evaluation.

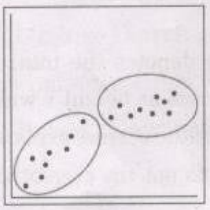
(a) Both Statement 1 and Statement 2 are correct.

(b) Both Statement 1 and Statement 2 are incorrect.

(c) Statement 1 is correct and Statement 2 is incorrect.

(d) Statement 2 is correct and Statement 1 is incorrect.

(ii) Which form of unsupervised learning does the following diagram indicate ?



(a) Clustering (b) Regression

(c) Reinforcement learning (d) Classification

(iii) Bag of Words is a _____ model which helps in extracting features out of the text which can be helpful in machine learning algorithms.

(a) Data Science (DS)

(b) Virtual Reality (VR)

(c) Natural Language Processing (NLP)

(d) Computer Vision (CV)

(iv) Which of the following represents an example of a recommendation system ?

(a) An online clothing store that offers a wide variety of clothing options.

(b) A search engine that retrieves relevant web pages based on user queries.

(c) An e-commerce website that displays customer reviews and ratings for products.

(d) A music streaming platform that suggests songs and playlists based on user listening history.

(v) Name any two search engines. Google,

(vi) What is the primary need for evaluating an AI model's performance in the AI Model Development process ?

(a) To increase the complexity of the model.

(b) To visualize the data.

(c) To assess how well the chosen model will work in future.

(d) To reduce the amount of data used for training.

5. Answer any **5** out of the given **6** questions : $5 \times 1 = 5$

(i) **Assertion (A) :** The term used to refer to the number of pixels in an image is resolution.

Reason (R) : Resolution in an image denotes the total number of pixels it contains, usually represented as height × width.

(a) Both (A) and (R) are true and (R) is the correct explanation for (A).

(b) Both (A) and (R) are true and (R) is not the correct explanation for (A).

(c) (A) is true, but (R) is false.

(d) (A) is false, but (R) is true.

(ii) When a machine possesses the ability to mimic human traits, i.e., make decisions, predict the future, learn, and improve on its own, it is said to have :

(a) Computational Skills (b) Learning Capability

(c) Artificial Intelligence (d) Cognitive Processing

(iii) **Statement 1 :** To evaluate a models' performance, we need either precision or recall.

Statement 2 : When the value of both Precision and Recall is 1, the F1 score is 0.

(a) Both statement 1 and statement 2 are correct.

(b) Both statement 1 and statement 2 are incorrect.

(c) Statement 1 is correct, but statement 2 is incorrect.

(d) Statement 1 is incorrect, but statement 2 is correct.

(iv) The concept of _____ is used to apply face filters on various social media platforms.

(a) NLP (b) Computer Vision

(c) Data Science (d) Block chain Technology

(v) The 4 W's Problem Canvas helps in identifying the key elements related to the given problem.

Which of the following is NOT one of the blocks of the Problem Canvas ?

(a) When (b) Where

(c) What (d) Why

(vi) Which domain of AI is used for interacting with virtual assistants such as Siri and Alexa ?

(a) Machine Learning (ML)

(b) Computer Vision (CV)

(c) Natural Language Processing (NLP)

(d) Technical Vision (TV)

Section – B

(Subjective Type Questions)

Answer any **3** out of given **5** questions on Employability Skills. Answer each question in **20-30** words. **3 × 2 = 6**

6. Give any two examples of how individual choices and behaviours can contribute in achieving sustainable development.
7. List any two common misconceptions about entrepreneurship.
8. What is the importance of time management in effectively dealing with stress ? Provide any one strategy for improving time management skills to reduce stress.
9. Mention any two measures that individuals or organisations can take to protect their data from theft and viruses.
10. The method of communication that you choose could affect the relationship with your peers, superiors and customers. Write the four factors on the basis of which you can choose the right method of communication.

Answer any **4** out of given **6** questions in **20-30** words each. **4 × 2 = 8**

11. Differentiate between Machine Learning (ML) and Deep Learning (DL).
12. What are the primary differences between Script-bots and Smart-bots ?
13. What do you mean by Evaluation of an AI model ? Also explain the concept of overfitting with respect to AI model Evaluation.

P.T.O.

14. For a healthcare organisation's objective of predicting disease outbreaks and efficiently allocating resources through the analysis of medical records, would you recommend using supervised learning or unsupervised learning as the preferred machine learning approach ? Explain your choice briefly.

15. What role does data play in AI based applications ? Name any two sources of online data collection for building any AI based application.

16. Differentiate between grayscale and RGB images.

Answer any **3** out of given **5** questions in **50-80** words each. **3 × 4 = 12**

17. What are Neural networks ? Briefly explain all the layers of a neural network.

18. Give any four examples of applications of AI that we see around us.

19. Consider the following two documents :

Document 1 : ML and DL are part of AI.

Document 2 : DL is a subset of ML.

Implement all four steps of the Bag of Words (BoW) model to create a document vector table. Depict the outcome of each step.

20. Consider the following graphs (Figure 1 and Figure 2) that demonstrate the two types of Supervised Learning Models of Artificial Intelligence. Identify and explain each model giving suitable examples of each.

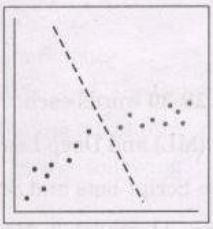


Figure 1

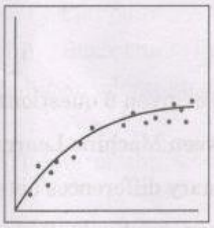


Figure 2

21. A binary classification model has been developed to classify news articles as either "Fake News" or "Real News". The model was tested on a dataset of 500 news articles, and the resulting confusion matrix is as follows :

Confusion Matrix		Reality	
		Yes	No
Predicted	Yes	45	15
	No	20	420

(A) How many total cases are True Negative in the above scenario ?

(B) Calculate Precision, Recall and F1-Score.