

iNTELLiCODE
ARTIFICIAL INTELLIGENCE CBSE CODE: 417
CLASS VI, VII, VIII
TEACHER'S REFERENCE MANUAL

Contents

CLASS VI	3
CHAPTER 1: WHAT IS INTELLIGENCE?	3
CHAPTER 2: GAME CODING IN SCRATCH.....	3
CHAPTER 3: WHAT IS ARTIFICIAL INTELLIGENCE?.....	4
CHAPTER 4: ROBOT SIMULATION WITH ROBOTBASIC	5
CHAPTER 5: AI AND MACHINE LEARNING.....	5
CHAPTER 6: PYTHON SAYS HELLO!	5
CLASS VII	6
CHAPTER 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE	6
CHAPTER 2: PROBLEM SOLVING WITH ALGORITHM AND FLOWCHART	6
CHAPTER 3: ARTIFICIAL INTELLIGENCE AND VISUAL DATA.....	7
CHAPTER 4: BASICS OF APP DEVELOPMENT	8
CHAPTER 5: AI AND HUMAN LANGUAGE	9
CHAPTER 6: PYTHON NUTS AND BOLTS.....	9
CLASS VIII	10
UNIT 1 - EXCITE	10
CHAPTER 1: GETTING READY FOR ARTIFICIAL INTELLIGENCE.....	10
CHAPTER 2: ARTIFICIAL INTELLIGENCE: TYPE AND TECHNIQUES	12
CHAPTER 3: APPLICATIONS OF ARTIFICIAL INTELLIGENCE.....	13
CHAPTER 4: DOMAINS OF ARTIFICIAL INTELLIGENCE.....	14
UNIT 2 – RELATE.....	17
CHAPTER 1: ARTIFICIAL INTELLIGENCE IN DAILY LIFE	17
CHAPTER 2: FUTURE YEARS WITH AI: SMART GADGETS AND HOMES.....	19
CHAPTER 3: AI AND SUSTAINABLE DEVELOPMENT ISSUES	21
UNIT 4 – POSSIBILITIES.....	23
CHAPTER 1: AI CAREER PROSPECTS IN INDUSTRY	23
CHAPTER 2: GETTING READY FOR AI-BASED CAREER	24
UNIT 5 – AI ETHICS.....	25
CHAPTER 1: ARTIFICIAL INTELLIGENCE AND ETHICS.....	25

EDUSOFT AS YOUR TEACHING-LEARNING PARTNER

The image displays a collage of educational content from Edusoft KnowledgeVerse. On the left, a banner highlights '650+ Educational videos at YouTube' with the URL 'www.youtube.com/edusoftknowledgeverse'. The central banner reads 'EDUSOFT KNOWLEDGEVERSE With Video-based Worksheets'. On the right, the 'Edusoft PLAYGROUND' logo is shown with the website 'playground.edusoft.co.in' and the tagline 'Your online learning portal', along with categories 'CODING | GAMING | ROBOTICS | AI'. Below these are several video thumbnails for topics like 'Kids Programming - SCRATCH', 'KODU GAME LAB', 'ARTIFICIAL INTELLIGENCE', 'Natural Language Processing', 'COMPUTER VISION', 'DATA SCIENCE SIMPLIFIED', and 'JavaScript Overview'. On the far right, a 'PLAYGROUND' interface features a child's face, a globe, and icons for various activities like 'Code Craze', 'Aston AI', 'Bingo Park', and 'SkillQuest'.

ACADEMIC AND SKILL ACTIVITIES

During the session, we conduct webinars, activities, contests and interactions that help you grow as learner and a teacher. This keeps us in touch to understand your changing needs better and to serve you in an improved way.

We are constantly striving in making your teaching-learning experience better and exciting in our own unique ways and will keep you updated on all the futuristic developments we are doing in this regard.

Please visit the following links that offer plentiful academic reference material useful for you:

- 150+ eBooks available at www.eduitspl.com/ebooks
- 500+ eContent videos available at www.youtube.com/edusoftknowledgeverse
- List of eContent videos (sorted class & topic wise) available at www.eduitspl.com/YLS
- Test Generator & Teacher Manuals available at <https://tinyurl.com/tkhwux89>

CLASS VI

CHAPTER 1: WHAT IS INTELLIGENCE?

A. Choose the correct answer.

1. c 2. d 3. d 4. a 5. c

B. Match the functions in column A with their use in column B.

1. b 2. h 3. a 4. c 5. g 6. f 7. e 8. d

C. Write the correct style of learning against the following traits.

1. Visual 2. Aural 3. Verbal 4. Kinaesthetic

D. Mark the following statements as True or False.

1. False 2. False 3. True 4. True 5. True

E. Answer the following questions.

1. Retaining facts and knowledge to apply in life is called learning.
2. There are different types of intelligence people have such as verbal, logical, interpersonal, musical etc. Due to this different people are good in different things.
3. As we grow since birth, our brain gathers intelligence through observation, training, schooling and practice.
4. Various types of intelligence are verbal, logical, spatial, kinaesthetic, musical, interpersonal, intrapersonal and naturalistic intelligence.
5. Visual – Strong imagination, Aural – good listeners, Verbal – good readers and writers, Kinaesthetic – practical doers, organisers.

CHAPTER 2: GAME CODING IN SCRATCH

A. Choose the correct answer.

1. d 2. b 3. a 4. c 5. b 6. b

B. Fill in the blanks.

1. Animation 2. Library 3. Control 4. Variable 5. Answer

C. Answer the following questions.

1. A block is the piece of code which we need to develop the script. Blocks are organised in various categories such as Controls, Variables, Looks, Motion, etc. A sprite is the visual character which works according to the script written. A sprite is added to the stage from sprite library or we can draw a new sprite.

2. To make a sprite move 100 steps, select that sprite icon below the stage and then in the script editor drag drop any event block such as “when green flag pressed” and below it drag-drop Motion block “move 100 steps”.

3. if-then block is used to check a condition. If that condition returns true then only the blocks inside “if” will execute. if-then-else also works the same way as “if” but, in it, if the condition returns false then the blocks in “else” part execute. E.g.:

```
if touches Sprite1 then
    move -10 steps
    turn 90 degrees
```

else

```
    move 10 steps
```

Here, if this sprite touches another sprite named Sprite1 then it will move back 10 steps and turn 90 degrees otherwise (else) it will move 10 steps.

4. Iterate means “to say”. Reiterate means “to say again”. Reiteration means to execute blocks more than once depending on the condition. This is done by the help of loop blocks such as repeat and forever. Repeat loop block takes a number as to how many times the enclosed blocks must run. forever block runs the enclosed blocks infinitely.

5. The data in our programs such as calculations or input given by the user is stored in named containers called variables. To create a variable, go to Scripts tab > Variables category > Click “Make a variable” button > in the popup, enter the variable name and click on OK button.

D. Match the following blocks with their correct function.

1 c 2 b 3 e 4 a 5 d

E. Identify and write the use of the following Operator blocks.

Arithmetic operation blocks: addition, subtraction, multiplication and division

Generate random number between two given numbers such as 1 and 10.

Comparison operators: greater than, less than and equal to.

Examine the information and find evidence.

1. False. Broadcast block sends message to all the sprites in the projects.
2. True.
3. False. On deleting the clone, the main sprite remains.
4. True.
5. True otherwise program will be stuck into continuous running.

CHAPTER 3: WHAT IS ARTIFICIAL INTELLIGENCE?

A. Choose the correct answer.

1. b 2. c 3. d 4. b 5. a

B. Match the terms in column A with the statements in column B.

1. c 2. d 3. b 4. e 5. a

C. Fill in the blanks.

1. Behaviour, properties 2. Natural language 3. Rules 4. Red 5. NLP

D. Mark the following statements as True or False.

1. True 2. False 3. True 4. False 5. True

E. Answer the following questions.

1. The art and science of developing machines intelligent like humans is called Artificial Intelligence.
2. Like humans possess different types of intelligence, machines can also be made to do different tasks. Depending on these tasks, machines are also differently intelligent.
3. The data and words analysed from our previous searches helps search engine determine what words to recommend in our next search.
4. AI algorithm detects online fraudulent transactions by looking for unusual trends like huge amount, number and speed of transactions in an account at a time, repeated attempts of login in an account etc.
5. An online map application calculates commute time, displays traffic conditions, finds the best possible shortest or fastest route and the current rides which we can share.
6. Assessing the popularity index of a product, person, commodity etc. by analysing the customer feedback and ratings is called sentiment analysis.
7. Fingerprint matching, face recognition, image identification.
8. Ability of an AI machine to process natural language is called Natural Language Processing

9. Speech recognition means recognising what is spoken and Voice recognition means recognising who has spoken.
10. Digital Assistants are devices that understand speech and execute the routine tasks such as playing a song, switching on the TV etc. Chatbots are used to handle customer queries and execute common requests on an online platform.

CHAPTER 4: ROBOT SIMULATION WITH ROBOTBASIC

No theoretical test. Chapter is completely practical oriented.

CHAPTER 5: AI AND MACHINE LEARNING

A. Choose the correct answer.

1. b 2. b 3. b 4. a 5. a 6. d 7. a 8. d 9. c 10. c

B. Classify the following sentences into Supervised, Unsupervised and Reinforced learning.

Supervised: 1, 3, 5 Unsupervised: 4, 6 Reinforced learning: 2, 7

C. Fill in the blanks.

1. Machine 2. Deep 3. Supervised 4. Unsupervised 5. Reinforced

D. Answer the following questions.

1. Machine learning is a sub-set of AI that is used to train the machine for forecasts and classification etc. Deep learning is advanced form of ML which is based on artificial neural networks.
2. In supervised learning, the machine is given the data along with the labels, rules-set and expected output while in unsupervised learning, only data is input to the machine and then it is left on its own to analyse the data.
3. Reinforcement learning is the machine learning approach based on reward-punishment approach. Machine learns by earning reward on successful steps and loss of reward when it does something wrong.
4. Weather prediction, image identification and classification of customers.
5. Grouping similar kind of customers, finding relationship between two entities, learning tasks such as driving.
6. Autonomous vehicle, stock market prediction, path-finding application.

CHAPTER 6: PYTHON SAYS HELLO!

A. Choose the correct answer.

1. d 2. a 3. d 4. b 5. c

B. Fill in the blanks.

1. Comments 2. Interactive 3. // 4. Strings 5. input()

C. Tick the correct answer

1. False 2. False 3. True 4. True 5. False

D. Answer the following questions.

1. The 2 applications of Python programming language are:
 - i. Web development
 - ii. Making games
 - iii. Data Analysis
2. # This is a single line comment.
 ""This is a multi

Line comment”

3. Interactive mode is useful to run or test individual statements quickly if you do not need to save them while script mode allows to save the script and then execute it anytime later.

4. / operator returns the returns value with decimal place (float). E.g., $3/2 = 1.5$

// operator returns integer value after division. E.g., $3/2 = 1$

% modulus operator returns the remainder of the division. E.g., $5\%3 = 2$

CLASS VII

CHAPTER 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

A. Choose the correct answer.

1. a 2. c 3. b 4. a 5. c

B. Fill in the blanks.

1. Smart chatbots 2. Humans 3. Data 4. Sentiment 5. Cumulative

C. Answer the following questions in one line.

1. Chatbots, preventing fraud, spam filter, prevent hate speech, face recognition.
2. Training data is used to train the AI model and testing data is used to evaluate the performance of the model to assess its training.
3. AI-robots for hotels, restaurants, hospitals, mines and construction sites.
4. Computers have very high computation speed but they cannot take their own decisions.
5. Humans learn by observing information, remembering and practicing.

Relate the Facts:

Match the correct matching pair of facts about humans and machines.

1 b 2 a 3 f 4 e 5 d 6 c

CHAPTER 2: PROBLEM SOLVING WITH ALGORITHM AND FLOWCHART

A. Choose the correct answer.

1. b 2. d 3. c 4. a 5. d

B. Fill in the blanks.

1. Programs 2. Flowchart, Algorithm 3. Language 4. Decision 5. Condition

C. Answer the following questions.

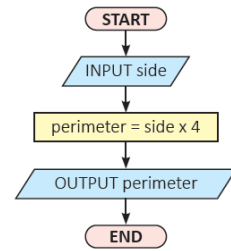
1. Algorithm is a set of steps arranged in a sequence to get the desired output. The instructions in an algorithm are clear and simple to understand. Instructions are written in common native language such as English. For example, below is the algorithm to calculate the perimeter of a rectangle.

Step 1. INPUT side

Step 2. perimeter = side multiplied by 4

Step 3. OUTPUT perimeter

2. Algorithms can be expressed in a graphical form called flowchart. A flowchart is a pictorial representation of an algorithm. Its graphical form makes it easier to understand the algorithm. For example, see the flowchart given here to express the above algorithm.



3. Two advantages of algorithms:

1. Algorithms are easier to understand due to 2 reasons:

- i. All the steps are mentioned clearly in them.
 - ii. They are independent of any programming language.
2. Any initial errors can be easily spotted and corrected.

Two advantages of flow charts:

- 1. Looking at flowchart, we can easily understand the flow of the program.
- 2. It is easy to analyse the solution of the problem.
- 4. A loop executes the statements repeatedly depending on given conditions. Usually, loops are represented by the block WHILE-END WHILE. For example, following loop displays a variable X 100 times.

Step 1. X = 0

Step 2. WHILE X < 100

Step 3. Display X

Step 4. Increase X by 1

Step 5. END WHILE

Examine information and find evidence.

Investigate the following statements and write down the facts you find.

- 1. False. Logical sequence of steps is important since a task can be done properly when the steps are executed in a desired way.
- 2. False. Arithmetic expressions help in performing calculations and processing the data.
- 3. True.
- 4. True. With the help of variables, we can deal with changing values easily just by referring to the variable name.
- 5. False. The loop constructs or blocks help computer execute statements repeatedly.

Compare Ideas

Match the symbols/boxes with use in the flowchart.

1. g 2. d 3. f 4. e 5. a 6. b 7. C

CHAPTER 3: ARTIFICIAL INTELLIGENCE AND VISUAL DATA

A. Choose the correct answer.

1. b 2. d 3. c 4. b 5. d 6. c 7. b 8. a 9. c 10. c

B. Mark the following statements as True or False.

1. True 2. False 3. True 4. True 5. False

C. Fill in the blanks.

1. Numbers 2. Images 3. Yellow 4. Satellites 5. Gray

D. Answer the following questions.

1. The 3 domains of AI are Data, Computer Vision and Natural Language Processing. Computer vision is the AI domain that deals with analysing visual data such as images, spatial data (satellite images), video frames etc.

2. Image is composed of millions of tiny elements called pixels. Each pixel has three basic colours – red, green and blue. RGB model is composed of 3 basic colours – red, green and blue whose mix of different intensities generates different colours. Minimum intensity is 0 and maximum is 255.
3. RGB colour model includes basic colours – Red, Green and Blue which is mostly used by image processing applications and digital devices. CMYK colour model includes basic colours – Cyan, Magenta, Yellow and Black. It is mostly used by printers.
4. Each image has 2 parts - Edge: Pixels that form the outline (edge) of any object in an image, Corner - It is composed of 2 edges in an image.
5. Object detection, cancer cell detection, face recognition, image-based search.
6. In RGB model, maximum colours available are $256 \times 256 \times 256 = 16777216$.

Investigate the information and establish facts

1. R1 2. R2 3. R1 4. R1 5. R1 6. R2 7. R1

CHAPTER 4: BASICS OF APP DEVELOPMENT

A. Choose the correct answer.

1. a 2. b 3. b 4. c 5. B

B. Fill in the blanks.

1. Android, iOS 2. Designer, Blocks 3. Event 4. Property 5. Control

C. Answer the following questions.

1. A mobile app is the software that runs on the handheld devices such as smartphones and tablets to provide desired services.

3 main features of mobile apps are:

- i. Apps are easy to download and install on the device.
- ii. Apps are mostly free and very lightweight (on memory and processor).
- iii. Apps generally do not have licence restrictions as software have.

2. A web app is the responsive version of the website. The in-built micro browser of the device displays the website interface on the small screen of mobile device. Web apps do not install on the user's device. On the other hand, a hybrid app has the features of both native and web apps. It combines the elements of native as well as web apps. It provides certain important features even if device is not connected with the Internet.

3. The Designer part of App Inventor allows the user to use the graphical elements to create the user interface of the app. Blocks part allows the user to use various programming blocks to add the functioning of the app.

4. In if-then-else block, the "else" part executes only when the condition with "if" returns false.

5. Control blocks: when _____.click, when _____.TouchDown

Math blocks: +, -, empty number

Text blocks: join, empty text, length

Variable blocks: initialize global, get, set ___ to

CHAPTER 5: AI AND HUMAN LANGUAGE

A. Choose the correct answer.

1. a 2. c 3. a 4. b 5. d 6. b 7. a 8. d 9. c 10. d

B. Match the column A with column B.

1. c 2. f 3. a 4. e 5. d 6. b

C. Fill in the blanks.

1. Digital assistant 2. NLP 3. Communication 4. Syntax, Semantics
5. Frequency

D. Answer the following questions.

1. Ability of an AI machine to process natural language is called Natural Language Processing
2. Sender: The agent person who needs to send the message across.
Receiver: The agent or person for whom the message is sent.
Channel: The medium through which message is sent.
3. Syntax refers to the grammar and formation of the language. E.g., They go. He goes. I go.
Semantics of a language refers to the underlying meaning of the language. E.g., I like to have juice in the morning. I like to drink juice in the morning. – Here, 'have' and 'drink' mean the same.
4. study, evolution (no change), train, simple, classify, data, easy, qualification (no change), eligible, form.
5. Digital assistants execute common tasks in response to the voice command given to them. They can answer almost any question asked, check mail, switch on the TV, tell latest news, play your favourite song etc.
6. Sentiment analysis is a process to find out what people feel about something by analysing their social interaction data. For example, a company wants to know how many people like/dislike their new product. Sentiment analysis determines the polarity in the data such as positive (like, happy or satisfied) or negative (dislike, unhappy, dissatisfied). Sometimes sentiments can be neutral.

CHAPTER 6: PYTHON NUTS AND BOLTS

A. Choose the correct answer.

1. b 2. d 3. c 4. d 5. d

B. Fill in the blanks.

1. + 2. Variable 3. AND 4. Zero 5. continue

C. Answer the following questions.

1. i. Python is absolutely free.
ii. Python is simple to learn and use.
iii. Python has a rich collection of built-in libraries of programs to pick and use. These libraries are arranged in uniquely named packages such as turtle, statistics, nlp etc.
iv. Python can run on all types of devices and operating systems.
2. i. Python has a rich collection of built-in libraries of programs to pick and use. These libraries are arranged in uniquely named packages such as turtle, statistics, nlp etc.
ii. Python is portable that means it can run on all types of devices and operating systems.
3. Operators perform certain operation (arithmetic, comparison, logical) on the data. The values on which an operator works are called operands. For example, in $8 + 13$, + is addition operator. 8 and 13 are operands.

4. Comparison operators return either true or false after comparing the values. For example:

```
A = 10
```

```
B = 50
```

```
if(A<B):
```

```
    print("small")
```

```
if(B==A):
```

```
    print("impossible")
```

Here, condition $A < B$ will return true since value of the variable A is less than ($<$) that of B. Condition $B == A$ will return false since values of variables A and B are not equal ($==$).

5. Logical operator NOT reverses the condition it precedes. For example, $\text{not}(5 == 10)$ will return true. First, the comparison $5 == 10$ returns false which will be reversed to true by not operator.

Relate the facts.

1 d 2 g 3 f 4 h 5 c 6 b 7 e 8 a

CLASS VIII

UNIT 1 - EXCITE

CHAPTER 1: GETTING READY FOR ARTIFICIAL INTELLIGENCE

A. Choose the correct answer.

1. c 2. b 3. d 4. d 5. a

B. Fill in the blanks.

1. Analytics 2. Knowledge 3. Deductive 4. Sensors 5. Inductive

C. State whether True or False

1. True 2. True 3. False 4. False 5. False

D. Very short answer type questions.

1. American Researcher John McCarthy coined the term "artificial intelligence" in 1956.
2. Our online navigation pattern is called browser fingerprinting. It is useful for businesses to identify us as the right customer.
3. A small file that contains details about the site visitor, such as login time is, called cookie.
4. Over a network, each device is identified by unique IP address.
5. Some modern-day smart gadgets are digital assistants (Alexa, Siri, etc.), smart watches, smart cameras, smart phones, autonomous vehicles in certain factories, etc.
6. The two functions AI exhibits are face recognition and natural human language understanding or processing.
7. Machines perceive their surrounding by the help of inputs received by various sensors such as heat sensor, proximity sensor, light sensor, etc.
8. A machine can be trained by the help of bulk data and by testing it after training.
9. A traditional computer does not learn from data while AI-enabled machine does. A traditional computer works on fixed set of rules built into a program or software. An AI-enabled machine evolves and improves its algorithm with more and more data.

10. The 2 challenges in achieving true AI are:
 - i. Retain the facts as knowledge
 - ii. Think, analyse and apply logic.

E. Very short answer type questions.

1. We receive a variety of stimulus constantly from our surroundings. Perceiving such stimuli is called sensing. Receptive organs help in sensing. Comparing facts and deriving conclusions is called reasoning.
2. According to John McCarthy – ‘AI is the science and engineering of making intelligent machines.’
3. AI is relevant today because we have enormous amount of data available to analyse, there are computers with highly advanced technology capable of processing bulk data continuously and there is advanced storage technology.
4. Humans sense various stimuli through their sensory organs to learn about the surroundings while machines use sensors for input. Humans understand natural languages while machines need to convert language and images into numeric form. Humans can reason and make decisions on their own while machines depend on the available data and the purpose of the task.
5. If conclusions are guaranteed after analysis then it is called deductive reasoning, if not, then it is called inductive reasoning. E.g. Deductive reasoning: “All computers need an operating system to work. Sam’s computer does not have operating system. Sam will not be able to start the computer.” Inductive reasoning: “There were zero cases of Covid infection in the area after vaccination. Rajat is from the same area so he will not be Covid infectant.”
6. It is challenging for a machine to learn natural human language due to the complexity of the language rules, multiple meanings of the words and phrases, variety related to vocabulary, pronunciation and accent. It is difficult for a machine to understand humour, sarcasm, tone and mood of the speech.
7. A self-driven car needs to be able to perceive surroundings, various objects around, distance from the objects, traffic signs and road conditions etc. For this, it must be equipped with proximity (distance) sensors, image scanner, microphones, camera and sensors to figure out the terrain (road/ground).
8. Traditional computers work on the basis of the logic and rules defined in the program loaded in them. Such programs only process data but cannot analyse the data to learn from it and make their own set of rules. Traditional computers cannot handle bulk data and their processing speed is also not sufficient for this purpose.
9. The challenges in the way of making intelligent machines are - it is difficult for machines: i. to retain knowledge, ii. To recall knowledge depending on the situation, iii. apply logic and iv. upgrade their intelligence further.
10. A traditional computer: i. follows specific instructions in a program (AI machine learns from data), ii. Process data (AI machine analyses data), iii. can process limited amount of data (AI machine handles bulk data.)

Case study/scenario-based questions.

A I. b

II. True

III. Advertisements are shown based on the analysis of our online interactions about our preferences and interests.

IV. Acquiring or collecting data.

V. By displaying relevant adverts to the right users increases the chances of sales and also saves users a lot of time and efforts.

B I. Hearing and looking

II. b

III. The basic expectations of a robot moving among the furniture in the room is to sense the obstacles and walls and circumvent them to avoid collision.

IV. c

V. Intelligence is the ability to reason by analysing the available facts or information.

CHAPTER 2: ARTIFICIAL INTELLIGENCE: TYPE AND TECHNIQUES

A. Choose the correct answer.

1. c 2. b 3. c 4. b

B. Fill in the blanks.

1. Narrow 2. Strong 3. Reactive 4. Socially

C. State whether True or False

1. False 2. True 3. False 4. True

D. Very short answer type questions.

1. A machine learning board game after multiple matches.
2. Human-like intelligent machine is based on Theory of Mind type of intelligence.
3. The 3 main components of reinforced learning are environment, agent and reward/punishment.
4. Deep learning models use several layers of artificial neurons.
5. A self-driven car works on the Limited Memory intelligence.
6. Humanoids exhibit intelligence based on the "Theory of Mind."
7. A machine that can understand and respond to the mood of a person is based on the "Theory of Mind."
8. Unsupervised learning-based machine is just given the data to analyse on its own.

E. Very short answer type questions.

1. Narrow or weak AI performs the tasks in a limited field of application while strong AI works in varied fields and situations. Weak AI is suitable to perform dedicated tasks while strong AI is versatile. Weak AI exhibits predefined set of functions only while strong AI applies knowledge to solve newly identified problems.
2. Reactive machines work on the basis of a set of rules and logic built into them. Since it has limited or narrow intelligence based on limited facts, it capable to learn about one or few specific tasks such as playing game or marking attendance bu recognising faces or recommending movies to viewers, etc.
3. Machines based on theory of mind understand expressions and emotions and capable to interact socially.
4. In reinforcement learning, any machine that is interacting with the environment is called an agent.
5. Deep learning is the ability of a machine to learn by processing data on its own and predict patterns in the data without having any guiding instructions from the developer. They work on the concept of artificial neural network.
6. In supervised learning, machine is provided the data as well as the details about the data and the expected outcome while in unsupervised learning, machine is only provided the data. It meaning and interpretation is done by the algorithm on it own.

Case study/scenario-based questions.

- I. False II. d III. Reinforcement learning IV. c
V. Deep learning makes use of multi-layered arrangement of artificial neurons to learn from the data and to analyse the data.

CHAPTER 3: APPLICATIONS OF ARTIFICIAL INTELLIGENCE

A. Choose the correct answer.

1. d 2. c 3. b 4. a 5. d 6. a

B. Fill in the blanks.

1. NLP 2. Chatbots 3. Banking, Education 4. Inference Engine 5. 5G

C. State whether True or False

1. True 2. False 3. True 4. False 5. False

D. Match the impact of AI in column A with their application area in column B

- 1 d 2 e 3 a 4 c 5 b

E. Very short answer type questions.

1. Simple and complex bulk data.
2. Ordinary task: Voice or face recognition
Formal task: Learning a strategy
3. Adaptive learning content as per user's ability to learn and smart, immersive learning environment for training purposes.
4. Speech recognition is the capability an NLP-enabled machine to understand what is said and voice recognition is its ability to identify who has spoken.
5. AI performs analysis of complex data of customer feedback and reviews to perform a sentiment analysis to deduce whether the customer liked/disliked or was neutral for the product or service.
6. Social media websites are using AI algorithms to identify hate speech and show targeted advertisements to the members.

F. Short answer type questions.

1. Main capabilities of AI are analysis of simple and complex immense data, smart search and natural language processing.
2. AI is capable to perform a variety of tasks after learning from the data. Some of the tasks are in the category of basic and formal tasks but today AI is capable to analyse complex and bulk data to see patterns and trends in it. With the help of these trends, AI can make predictions of future or forecast the occurrence of any event in future. For example, analysing weather data to predict rains or floods or yield of crops or identifying and classifying a huge library of documents.
3. Education field is mostly related to the natural language processing areas. Here, AI -based systems can help in different ways such as analysing the learners' performance and accordingly displaying the next content to them. Classifying documents such as books and project reports, voice-enabled question-answer smart bots, voice-based search and enquiry, intelligent virtual simulations in fields such as science and sports, evaluating assessments, assistance in teaching, reading out documents, handwriting recognition, etc.
4. Speech recognition and voice recognition are the part of the NLP domain of AI. An AI application which can understand what has been said by the customer is a speech

recognition application such as Alexa or Siri. If an AI application can also figure out who has spoken then it is called voice recognition. For example, voice-based passwords.

5. In customer support field NLP is used as smart voice response systems and chatbots which understand what has been spoken. They answer structured questions and understand the intent of the customer faster and accurately.
6. On social media, people are exposed to all kind of language and content so it is necessary to monitor and control what people are sharing online. AI algorithms help in identifying hate speech, fake news in content and images. AI algorithms can sense any anomaly such as cyberbullying. Algorithms keep the user data safe from unauthorised access.
7. Data related to social issues and demography is immense and very complex. Poverty and hunger and major problems of developing and under-developed countries. Acquiring data about them and analysing them with the help of AI is faster and more informative since AI can see patterns in the data which human mind cannot. This way, it helps in devising effective policies to deal with poverty and hunger.
8. Defence uses AI in many creative ways such as making intelligent weapons, intelligent attack sensing machines, robotics that minimises human casualties, deciphering enemy codes and hacking enemy systems, etc. E-Commerce industry has immense amount of data for AI systems to process and perform useful forecasts about customers, recommend products through digital marketing and develop better customer relations, create better shopping experience and address problems faster and accurately.

Case study/scenario-based questions.

A I. AI-based education system can analyse learning patterns and performance of learner to present suitable content (adaptive learning).

II. Speech

III. True

IV. A smart chat bot is based on algorithms that learn from the interactions and become more and more efficient in answering the queries while ordinary chat system follows fixed set of rules and cannot learn from the data.

V. Analyse trends in user interactions and preventing spread of hate speech and fake news.

B I. Demography or population and environment.

II. Social data and environment (weather, agriculture, etc.)

III. Ability to analyse bulk data faster and to identify useful trends in data.

IV. Higher hunger index can be addressed by finding employment opportunities to remove poverty and thus hunger.

V. AI can help improve agriculture by accurate predictions related to crop yield, water conditions and plant diseases, etc.

CHAPTER 4: DOMAINS OF ARTIFICIAL INTELLIGENCE

A. Choose the correct answer.

1. b 2. c 3. b 4. c 5. d

B. State whether True or False

1. False 2. True 3. False 4. True 5. False

C. Very short answer type questions.

1. AI systems learn from data. More the amount of data, better would be the learning of AI system. It is like humans learn from multiple books.

2. AI systems handle enormous, dynamic and complex form of data which is generated from a variety of sources. Such data is called big data.
3. Big data is enormous in volume and it comes from a variety of sources (heterogenous). It is continuous and unstructured also.
4. Before using the data to train AI model, it needs tidying up or cleaning to remove irrelevant data and missing values, to be validated and checked for suitable training of the AI model.
5. Computer Vision domain of AI deals with visual data such as images and video.
6. NLP or Natural Language Processing is the AI domain that deals with data in the form of speech and audio.
7. Face recognition, finger print recognition, image-based search, object identification, autonomous vehicle, verification by image, cancer cells identification, physical diagnosis of patients.
8. Speech recognition (what is spoken), voice-based support systems, voice recognition (who is speaking), voice command operated gadgets.

D. Short answer type questions.

1. Most of the industries deal with business data that is useful in many ways. Business data and data related to various operations in mostly in text and number form instead of visual or audio. Even visual and audio data are converted to numeric form for AI models to understand and use. Hence, data is the most important domain of all.
2. AI models need relevant and validated data for suitable training. Data should not be out of context. Data values must be relevant to the problem. Data values should be correct and without missing values. Higher the volume of data, better would be the training of the machine. There must be sufficient data for testing the model also. Data must be accurate and from verified sources. Data should have no missing or invalid values.
3. Every human language has two major aspects – syntax and semantics. Syntax refers to the grammar and structural formation of the language such as formation of sentences, use of various building blocks of language such as nouns, articles, adjectives, adverbs, tenses, etc.
Semantics refer to the underlying meaning of the words and sentences. Language has straight meaning as well as hidden or underlying meaning in the form of sarcasm, emotions, tones and style. Meaning also changes with changing context, dialect, areas and cultures.
4. Facial Recognition: Facial recognition is a security features in handheld devices and computers to unlock the device. It is useful in identifying faces of suspects, missing persons and known criminals. Facial recognition is useful in many areas such as attendance, image identification, etc.
Document Verification: Industries such as banking and finance, travel (passport, visa, identification documents), real estate, legal services (courts and panchayats), vehicle registration and verification are major areas for CV capabilities.
Education and Learning: Learning based on augmented reality and virtual reality need CV algorithms to convert all the static content into interactive immersive content for learning. Generating 3D visual from a 2D image.
Autonomous vehicles: In an autonomous vehicle, CV technique helps process real-time, rapid visuals. The CV algorithms controlling the vehicle is faster in processing speed so that instant control actions could be performed. CV algorithm is able to

quickly identify still and moving obstacles, road signs, other vehicles, correct route, road conditions, distance from other objects, etc.

5. Natural Language Processing domain involves the development of smart chat bots, voice command-based systems, documents classification, voice classification, and speech recognition. These capabilities are useful in making intelligent systems where human language is used such as reading emails, identifying fake news, identifying hate speech, analysing sentiments, summarising text, generating new text, answering questions, interacting in social manner with people, etc.
6. Just like we humans learn better with multiple sources of information, a machine learn better with enormous amount of data. More data covers all aspects of the area or domain in a better way. When the information is available in greater detail then AI model develops better rules to deal with real data. With more and more data, in due course of time, AI algorithm gets accurate and precise in its outcome.
7. Practically, it is difficult to determine the relevant data. Which data is needed and what should be discarded? – It is a time taking process.
The amount of data is enormous and in many cases it keeps increasing continuously such is on social media websites.
Higher costs are involved in handling enormous data and to pay for skilled resources. Investment in the continuous updates in AI models is also expensive.
8. The 2 examples of Computer Vision are object identification in an image and face recognition. The 2 examples of NLP are voice based chatbots and question-answer based voice operated assistant. Other examples are Alexa, Cortana and Siri. (Refer to CV applications and NLP applications).

E. Case study-based questions.

A. I. Analyses

II. c

III. Voice is in waveform. It is not consistent in its structure. Every voice pattern is unique and changes rapidly hence it is unstructured.

IV. Video is a complex form of data.

V. CV: Face recognition, NLP: Smart chat bot.

B. I. When an AI model deals with any audio-visual data then CV and NLP both the domains are combined.

II. Voice commands

III. c

IV. Printout is being scanned hence CV and readout of text hence NLP.

V. Natural language processing.

UNIT 2 – RELATE

CHAPTER 1: ARTIFICIAL INTELLIGENCE IN DAILY LIFE

A. Choose the correct answer.

1. c 2. a 3. b 4. d 5. a

B. Fill in the blanks.

1. Online presence 2. Social platforms 3. Smart assistants 4. Learn
5. Sustainability

C. State whether True or False

1. False 2. True 3. True 4. False 5. True

D. Very short answer type questions.

1. Sentiment analysis is an NLP application to analyse social media data (posts and interactions) and classify them as Positive, Negative or Neutral. It helps in customer satisfaction analysis and sentiments of masses for a celebrity or public figure.
2. Unsolicited (unwanted) emails that drop into our inboxes are called spam. Spams may contain harmful programs. Smart email systems can identify spams and remove them.
3. Smart chat bots can understand and process natural human language. They can learn from the interactions and provide better services further. They understand from the parts of the language and simulate conversation with a real person.
4. Amazon Alexa, Apple Siri, Google Assistant, Microsoft Cortana.
5. AI helps E-commerce websites in predicting customer behaviour related to new purchases, return of the items, recommend products to others, etc.
6. A smart city provides conditions conducive to live in (clean, healthy environment, quick access to services) and work (clean, non-stop energy and better connectivity) without running the risks for future generations (sustainable).
7. AI can help government in dealing with the problems related to hunger, unemployment, pollution and poverty.
8. AI can help educational institutes to provide adaptive content in courses, chatbots for course enquiry or course revision, help research students in collecting information.

E. Short answer type questions.

1. Artificial intelligence algorithms can identify spam emails and filter them out automatically to prevent clutter of mail box. Smart email drafting feature predicts the content that you intend to type. It can check if you have not forgotten to attach the file you talked about in the message. It prompts you to take action on an email not read for long by displaying a message beside that mail. This feature is called nudge. Assistance in multi-lingual messages and access to translation services are other features. An AI system can slowly learn about your emailing pattern and help you organise your mails efficiently.
2. AI-enabled social media websites help in user safety as follows:
 - i. Spotting fake news.
 - ii. Spotting hate speech and prevent it.
 - iii. Prevent sharing of violent content or bullying content.
 - iv. Spot any anomaly that indicates suspicion, hostility and criminal intent.
3. Sentiment analysis is a very useful feature of natural language processing AI domain. In this feature, the AI algorithm analyses the social media posts of the people and classifies them as Happy (Positive), Not happy (Negative) or Neutral. Fans who follow celebrities and public figures keep posting about them on social media platforms such as Twitter, Meta (Facebook) and Instagram. AI-enabled algorithms analyses these posts and figure

out the popularity index of the concerned celebrity. This is helpful for the person to make strategical decisions to maintain his/her popularity among masses.

4. Chatbots and digital assistants are popular NLP applications. Chatbots work with text chat as well as voice chat while digital assistants usually work with voice commands. Chatbots are useful in implementing enquiry systems on websites or customer support systems. User can interact with chatbot for specific detail or complaint and chatbot intelligently resolves it. Digital assistants are more personal. They are in the form of app or smart gadget like Alexa. They understand human language and respond in human language just like we talk to a person. They help in information search, checking email and even controlling gadgets (TV, music system, AC, etc.) at homes and offices.
5. Entertainment industry has two major areas – movies and games. Online movie portals use AI to collect data related to viewer's preferences about various shows and movies and use it to help AI recommend new movies and to provide engaging user experience on the website. AI-based games become more intelligent as user plays with them and pose more challenge in winning the game. This feature is also useful in game-based training and teaching.
6. A smart city provides conditions conducive to live in (clean, healthy environment, quick access to services) and work (clean, non-stop energy and better connectivity) without running the risks for future generations (sustainable).
AI can help smart city in following ways:
 - a. AI-enabled traffic system and public transport.
 - b. Machine learning and AI enabled bots/drones to help in analysing agricultural and environmental data for a huge variety of issues such as pollution, air quality, climate change, environment abuse and accurate weather prediction.With the aid of AI, Machine Learning and Deep Learning, E-Governance can have prediction of trends in huge demography data to implement effective measures against social issues.
7. The 3 ways in which a smart city can be more environment friendly with the help of AI are:
 - a. AI-enabled smart electricity systems to analyse dynamically changing power demands, analysing power consumption to assess adequate power usage.
 - b. Smart waste disposal systems wherein dustbins and waste containers signal the waste collection unit when they are about to fill.
 - c. Machine learning and AI enabled bots/drones to help in analysing agricultural and environmental data for a huge variety of issues such as pollution, air quality, climate change, environment abuse and accurate weather prediction.
8. AI systems can help in public healthcare, rehabilitation through AI-assisted physiotherapy, data analytics for prevention of disease outbreak. Studies related to population can be helped by AI - looking for useful trends and patterns to control poverty, hunger, homelessness, unemployment, malnutrition etc. For issues related to land, agriculture, and environment, AI can help in preventing damage to environment, managing damage due to natural calamities, improving agricultural practices and improving environmental care. In a nutshell, using AI, government can make informed decisions and effective strategies to counter social issues.
9. Smart email drafting is an AI enabled feature in popular email services such as Gmail. This algorithm trains itself by the emails drafted by the user and then creates smart suggestions when user drafts a future mail. With every new mail drafted, this algorithm

gains suitable intelligence to generate accurate suggestions thus saving time and effort needed while drafting new emails.

10. A nudge is a smart follow-up reminder for the mails received but still lying unread in user's inbox. This prevents overlooking of any important mail by the user by mistake. It is a bold, colourful one line reminder that appears right below the subject line of the mail in the inbox.
11. Chatbots use Natural Language Processing (NLP) algorithms trained by the grammar, semantics, phrases, keywords and other such language features. With user interactions, they learn and evolve in the logic to understand better what has been spoken. This way, chatbots evolve in responding to the user voice interactions in near human way.
12. One real-life user experience while online shopping is listing of recommended products depending on the previous buying behaviour and preferences by the user. For example, those cookery books which are in same price bracket, written by the same author or published by same publisher are listed to the user which user is contemplating to buy at a moment online.
13. The 5 areas where AI can help in making a city smarter are traffic, public services, waste disposal, smart schools, public safety and security.

F. Case study-based questions.

- A** I. Visitors of the social media websites. II. Both complex and unstructured.
III. Prevent hate speech, identify fake news, sentiment analysis.
IV. The reviews posted by the customers about the product are analysed by AI algorithms to classify them as positive, negative or neutral. This is called sentiment analysis.
V. Using sentiment analysis, an AI algorithm can find out a person's preferences. According to those preferences the person should be shown advertisement he/she likes. This way digital marketing can be made effective by AI.
- B** I. Identification of spam can save inbox space and help prevent harmful emails.
II. For any mail, a quick smart reply can be clicked thus saving time and effort of the user.
III. Nudges are the colourful reminders that appear beside a long unread mail and prompt user to read it.
IV. The source of learning for an AI algorithm in smart email drafting is our email drafting language and style.

CHAPTER 2: FUTURE YEARS WITH AI: SMART GADGETS AND HOMES

A. Choose the correct answer.

1. d 2. a 3. a 4. b 5. c

B. Fill in the blanks.

1. Smartphone 2. Controller 3. Smart home hub 4. Scheduled 5. Algorithm

C. State whether True or False

1. False 2. True 3. True 4. False 5. True

D. Match the following.

People – represent the society culture and civilization; Planet – represents the environmental and natural life; Profit – represents the economic issues; Policy – refers to the political leadership & policies to ensure sustainable development.

E. Very short answer type questions.

1. IoT is the concept of networking smart devices which can communicate over WiFi, Bluetooth and Internet to share data and signals. They can be controlled with a main device such as a smart phone.
2. Reduce, Recycle, Recover and Reuse.
3. People, Planet, Profit and Policy.
4. Society SDGs – Zero hunger, Quality Education
Economy SDGs – Reduce inequalities, Responsible consumption and production.
Environmental (Biosphere) SDGs – Life on land, Life below water.
5. No poverty SDG is top priority.

F. Short answer type questions.

1. The three fundamental components to sustainable development are Economic development, social development and environmental protection. Economic development is about providing incentives for businesses and other organizations to adhere to sustainability guidelines. Social development is about awareness and protection of the health of people from pollution and other harmful activities of business. Environmental protection is the need to protect the environment.
2. Sustainable development encompasses 4 Ps: People who represent the socio-cultural issues. Planet which represents the environmental issues. Profit that represents the economic issues. Policy which refers to visionary political leadership and implementation of policies needed to make sustainable development a reality. Today, countries are agreeing to the importance of conserving natural resources. People are adopting to greener ways, farmers are practicing smart agriculture and industries are practicing energy efficiency.
3. India as a responsible country has taken some environment friendly initiatives as below:
 1. India earlier followed Kyoto protocol to fight climate changes and signed Paris agreement focusing on bringing down global temperatures.
 2. India is second highest in the world, after China, in running 1500+ projects in energy efficiency, fuel switching and solid waste management.
 3. Climate change programs focusing on water, agriculture, tourism, transport and forestry etc. are run in 32 states and union territories.
 4. India levies carbon tax on industrial coal usage. Clean energy initiatives and research is funded under National Clean Energy fund created by this tax.
 5. A huge fund has been provisioned to take care of the areas which are vulnerable to the adverse effects of climate and environmental changes.

4.

1. Complete poverty eradication (Society)	2. Zero hunger (Society)
3. Good health and well-being (Society)	4. Quality education (Society)
5. Gender equality (Society)	6. Clean water and sanitation (Society)
7. Affordable and clean energy (Society)	8. Decent work and economic growth (Economy)
9. Industry, innovation and infrastructure (Economy)	10. Reduces inequalities (Economy)
11. Sustainable cities and communities (Society)	12. Responsible consumption and production (Economy)
13. Climate action (Biosphere)	14. Life below water (Biosphere)
15. Life on land (Biosphere)	16. Peace, justice and strong institutions (Society)
17. Partnerships for the goals (Economy)	

G. Case study-based questions.

A I. Society, economy and environment.

II. Creativity, knowhow, technology and financial resources from all of society.

III. False.

IV. Poverty increased by 7% in just a few months due to Covid pandemic.

V. Basic needs such as health, education, clean water and sanitation.

B I. “we all” refers to all the people/citizens of the country.

II. True

III. Economic development and social development should not occur at the cost of environment.

IV. The balance of economic development, social upliftment and healthy environment makes a society sustainable.

V. a

CHAPTER 3: AI AND SUSTAINABLE DEVELOPMENT ISSUES

A. Choose the correct answer.

1. d 2. c 3. a 4. b 5. c

B. Fill in the blanks.

1. Data 2. Data-vision 3. Predictive analytics 4. Object detection 5. NLP

C. State whether True or False

1. False 2. True 3. True 4. True 5. True

D. Very short answer type questions.

1. Complex data in society: poverty data, hunger data, unemployment, malnutrition, illiteracy, crime, etc.

Complex data in environment: air quality index, pollution, agriculture, natural calamities, forest fires, etc.

2. Ability to process bulk data faster, making predictions and forecasts, learn from data.

3. The prime issues among all SDGs is poverty. If this is eradicated, many related problems will solve.

4. AI enables LMS learns form the study pattern of the student and delivers course content accordingly.

5. Industries deal with bulk data. AI models can help in predicting future trends, help in processing graphical data (computer vision) and provide language based smart solutions (NLP).

E. Short answer type questions.

1. Five AI features helpful in addressing sustainable development issues are:

i. Ability to process huge amount of data such as data related to climate, population and pollution etc.

ii. Faster processing speed to accomplish analyses in a few hours as compared to days or even months.

iii. Ability of accurate forecasts to raise alarms and preventive alerts.

iv. Ability to learn from the data to evolve autonomous algorithms that save a lot of human effort.

v. Ability to process complex data such as images (Computer Vision) and language (Natural Language Processing).

2. AI's Computer Vision and Natural Language Processing help in developing sustainable and effective educational systems, ability to process bulk data and forecast results help in analysing bulk data related to illiteracy and unemployment to help devise better policies for education for all and skill development for self-employment and to address problem of unemployment. Help physically challenged people in self-paced learning and gain skills to earn their livelihood with least help from others – this way promoting equality, helping people learn new skills faster.

3. AI can help in creating customised educational material as learners need. Fun oriented, game-based modules can be managed by the help of AI powered learning management system (AI-LMS). Teachers can also be empowered for efficient teaching through better feedbacks on students' achievements.

4. Environment is one of the largest sources of bulk data which is useful for many purposes using AI models. Weather forecast, prediction of flood/drought, detection of forest fire, analysis of pollution data and air quality index, issues related with e-waste, suggesting crops from agricultural data, detecting plant diseases, data related with global warming, space research and many such fields are benefited by AI.

5. AI systems can analyse the data related with population, unemployment and illiteracy to generate useful insight and patterns. These patterns can help in understanding the social needs and government can create better strategies to fight the abovementioned crises. This will ensure in creating an equitable society.

F. Case study-based questions.

I. Poverty is in the root of other social crises such as unemployment, illiteracy and uneven distribution of resources.

II. a

III. True

IV. AI systems can map the money-earning opportunities with people's skills to enhance employment process to fight poverty.

V. Satellite images and data related to climate change, pollution, global warming, etc. can be fed to AI models to have useful insights which help government to devise effective policies to deal with environmental issues.

VI. Employment opportunities help poor in earning money and uplift themselves in society. Employed families get their children educated who can easily be employed in future.

VII. A smart city provides suitable conditions to live and work and that is energy-efficient as well as environment-friendly.

VIII. Object detection is the computer vision capability of AI to identify specific objects within an image.

IX. IoT

X. Social crises and environmental issues.

UNIT 4 – POSSIBILITIES

CHAPTER 1: AI CAREER PROSPECTS IN INDUSTRY

A. Choose the correct answer.

1. d 2. a 3. c 4. d 5. a

B. State whether True or False

1. False 2. True 3. False 4. True 5. True

C. Match the following.

1. c 2. d 3. e 4. b 5. a

D. Answer the following questions.

1. i. Data: Identifying trends and patterns in bulk data-sets, accurate predictions.

ii. Computer Vision: Object identification in the images, face recognition.

iii. Natural Language Processing: Interpreting human speech, converting text to speech and vice versa.

iv. Artificial Neural Networks: Learning from data-trends for more accurate predictions, self-learning algorithms for autonomous applications.

v. Robotics: Doing tasks that involve dangers and risks for life, automated physical assistance.

2. In E-commerce, computer vision helps in developing AI enabled image search, product identification and secured access while NLP helps in the form of interactive chatbots, voice enabled search, customer support and grievance redressal systems.

3. In customer support, computer vision helps in image-based search, secured access of systems, assistance to physically impaired and elderly persons, customer identification and classification of products, users and other objects.

4. AI possibilities in education and training are predictive analysis of learner performance, demand of course, learning behaviour of students by processing learners' data, NLP based FAQ, course guides, educational activities, admission assistance, consultation, exam details etc., computer vision in identifying images such as books, assistance to physically impaired (audio keyboard for blinds), attendance by face recognition etc., machine learning based evolving algorithms for adaptive course content and do more accurate forecasts.

5. Robotics finds its application in every such area where there is a physical challenge in performing a task or threat to human life. Such areas are manufacturing units, mining operations, rescue operations, defence and counter attack operations, oil rigs and natural gas extraction sites, public safety services against fires, natural disasters and crime, robot assisted medical surgeries, bots for surveillance, autonomous vehicles, visit and research of unreachable areas such as underwater, underground, space, mountains and hostile areas.

6. Any industry that deals with images and visuals can provide career opportunities related to Computer Vision with AI. Some of these are entertainment, graphics and design, medical imagery and diagnosis, designing new drugs and vaccines, research of virus structures, defence research, computer aided designing, security, sports, space research, document identification and classification, etc.

7. Natural language processing capabilities of AI can help aspirants to find job and career opportunities in the fields of developing smart bots, classification of digital documents, interactive voice response systems, voice command-based systems and devices,

developing intelligent educational systems, training industry, multi-lingual systems (entertainment, online courses), machine translation, voice recognition, etc.

8. Machine learning deals with the process of training the AI models with data to perform variety of tasks. Career prospects of machine learning are tremendous in almost every industry that deals with bulk data. After learning a machine can do predictions, identify objects, classify images, perform cluster analysis, develop autonomous vehicles, do predictive analysis of data, automate complex tasks, etc.

9. Job descriptions related to AI are:

i. Identifying trends and patterns in data-sets.

ii. Object identification in images.

iii. Interpreting human language and speech.

iv. Learning from data to perform various data-related tasks.

v. Automated tasks in disastrous conditions with the help of intelligent robots.

10. Computer vision related career opportunities in healthcare are image-based diagnosis, intelligent devices for patient care, assistance to physically impaired, document scanning, image sorting, face recognition, etc.

In education there are document identification, validation through face recognition, image based assessments, text extraction, document correction.

11. In transport, career in robotics can be in the form of design autonomous vehicles, drone-based service delivery systems, loading-unloading heavy weight, carrying and placing heavy weight.

In security, robotics can be used in designing intelligent weapons and attack vehicles, surveillance, mob control, rescue operations, domestic and industrial security.

12. In entertainment industry, career opportunities related to machine learning include develop AI models for predictive analysis or popularity trends, sentiment analysis, learning from customer preferences and generate intelligent recommendations of movies and songs, automation of routine tasks. In R&D, machine learning careers include developing intelligent search assistants, automating search, finding patterns in data connections, prepare information summaries, archiving search results.

13. Refer to Keywords list at the end of the chapter.

CHAPTER 2: GETTING READY FOR AI-BASED CAREER

No assessment

UNIT 5 – AI ETHICS

CHAPTER 1: ARTIFICIAL INTELLIGENCE AND ETHICS

A. Choose the correct answer.

1. b 2. d 3. c 4. d 5. b

B. Categorise the following statements into *Traditional Computing* and *AI Development*.

Traditional Computing: 1, 5, 7, 9 AI Development: 2, 3, 4, 6, 8, 10

C. Very short answer type questions.

1. The principles and morals that govern our behaviour are called ethics. They serve as a guideline for us to distinguish between right and wrong.

2. The traditional program is based on algorithm developed to perform specific tasks while AI algorithms are dynamic and designed to learn from the data.

3. Discriminating on the basis of gender, race, colour, region etc. is called bias.

4. i. Humans will be replaced by AI leading to job losses.

ii. AI will be biased leading to unfair results and decisions.

iii. How AI will take care of human dignity and rights?

5. i. Enhancing human potential.

ii. Bringing and maintaining equality.

iii. Uplifting harmony.

6. i. Human rights

ii. Transparent AI systems

iii. Accountability

D. Answer the following questions.

1. The principles and morals that govern our behaviour are called ethics. They serve as a guideline for us to distinguish between right and wrong. Artificial intelligence involves faster processing and a remarkable impact (both positive and negative) on industries, society and environment. It has the ability to go out of control if not monitored properly through stringent policies and great care. Unethical use of AI may lead to great many threats to human rights, equality issues (biases), life threats, social conflict and negative effect in the application area instead of providing intended benefit. This is the reason addressing ethical issues and devising their preventive plans are important.

2. Discriminating on any basis (gender, colour, race, religion, social standard, etc.) is called bias. There are pre-existing biases in the system due to the social structure. Incomplete social data leads to pre-existing biases. Software systems have technical biases due to logical bugs or flaws. Emergent biases are discovered when system comes in use by different users in different ways.

3. Traditional Programming vs AI Development (5 differences) are:

TRADITIONAL PROGRAMMING	AI DEVELOPMENT
The program is based on a finalized algorithm which is fixed for one or more versions of the program.	Algorithms are dynamic and designed to learn from the data.
Data is required to be processed for desired output.	Data is needed for two purposes broadly: i. to train the machine and ii. To analyse.
Data is mostly structured and well classified.	Data is unstructured with several variables needed to train the system.

Forms a vast field of computer science and computer applications.	Integrates computer science, data science, statistics, math, research and business intelligence.
Deals with a limited size of data. Bulk data is processed in batches.	Deals with complex, dynamically changing and growing immense amount of data collectively called Big Data.

4. Five ethical characteristics of good AI are enriching human life, working towards equity, easing conflicts and promoting harmony, addressing un-addressable problems and addressing environmental abuse.

5. Think of a self-learning and evolving AI system. There should be enough and appropriate guidelines and process to determine the ethics of action taken by such an AI system. The accuracy and suitability of data used to train it needs stringent checks. Ethical guidelines need to be in place to ensure that AI enabled system is taking decision and serving in a transparent manner avoiding any sort of bias on any basis such as gender, race, ethnicity, region, financial and social status etc. For such biases, proper accountability guidelines need to be devised. This all will ensure an ethical AI-based service system.

6. Four major ethical challenges related to AI are accountability, biases, privacy and human values.

Accountability: There should be rational guidelines to govern the working of AI system and the its ability to make decisions.

Human values: All AI systems should respect, promote and protect human rights.

7. Four ethical framework principles are Human rights, rights related to data and privacy and awareness about misuse.

Human rights: AI system should be developed in such a way that it should not compromise on human dignity and values. It should respect and protect human right.

Rights related to data: People should have rights and ways to control their data. They should decide with whom to share the data. AI systems should respect the right to individual identity.

8. A policy framework can help in establishing ethical AI by revising existing human rights policies in the light of AI, considerations of impact of AI on economy and gross domestic product, people's right to their data and privacy, testing and benchmarking systems for measuring efficacy and effectiveness of AI systems, laws to address AI system malfunction consequences and issues, devising accountability for functioning of AI systems, ensuring screening policies to ensure authorised, qualified and expert individual involve in developing and handling AI ecosystems.

E. Case study/Scenario-based Questions.

I. Super-intelligence is the intelligence that surpasses human intelligence.

II. False

III. c

IV. If people are in control of their data, then they will not be vulnerable to surveillance, hacking, cybercrimes etc.

V. Before having me registered on their website the company must inform me how they are going to use my data and that my data is safe and secure.

VI. Data privacy and data protection are important to prevent our sensitive data fall into unauthorised ownership for misuse.