Computer: A Wonder Machine
BOOK 7

Chapter 1
Number System—An Introduction

1. Answer the following questions:

(a) The computer translates words and letters into numbers before storing, because computer understands only numbers. Therefore, we can say that computers talk and understand only numbers.

(b) Number System are of the following types:

(i) Decimal Number System

(ii) Binary Number System

(iii) Octal Number System

(iv) Hexadecimal Number System

(c) (i) Decimal Number System is a number system that we use in our day-to-day life.

- Base for decimal number system is 10 as it uses 10 digits (0,1,2,3,4,5,6,7,8,9).
- In all the number systems, the first digit is zero.
- In all the number systems, the maximum value of digit is one less than the value of base.
- It is also known as base-10 system.
- In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands and so on.
- Digits signify different values depending on the position it occupies in the number.

For example, in $(2789)_{10}$—

9 signifies $9 \times 10^0 = 9 \times 1 = 9$

8 signifies $8 \times 10^1 = 8 \times 10 = 80$

7 signifies $7 \times 10^2 = 7 \times 100 = 700$

2 signifies $2 \times 10^3 = 2 \times 1000 = 2000$

On adding them = 2000 + 700 + 80 + 9 = 2789

(ii) Binary Number System

The characteristics of binary number system are as follow:

- Binary number system has only two symbols or digits, *i.e.*, 0 and 1.

- Binary number system is also known as base-2 number system.
- Each position in a binary number represents a power of the base (2).

  Hence, the rightmost position is the units (2^0) position. The second position from right is the 2's (2^1) position, and proceeding in this way.

  For example, 10101 or $(10101)_2$ is

  $= (1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0)$

  $= (1 \times 16) + (0 \times 8) + (1 \times 4) + (0 \times 2) + (1 \times 1)$

  $= 16 + 0 + 4 + 0 + 1$

  $= (21)_{10}$
- Binary equivalent of decimal digit 2 is 10 or $(10)^2$, read as one zero and not ten.
- With n bits (n positions) only 2^n patterns are possible. (Binary digit is also referred to as bit)

(d) (i) 455_{10}

Repeated Division		Remainders
2	455	
2	227	1
2	113	1
2	56	1
2	28	0
2	14	0
2	7	0
2	3	1
2	1	1
	0	1

Write in this order

$455_{10} = 111000111$

(ii) 79_{10}

Repeated Division		Remainders
2	79	
2	39	1
2	19	1
2	9	1
2	4	1
2	2	0
2	1	0
2	0	1

Write in this order

$79_{10} = 1001111$

(iii) 1679_{10}

Repeated Division		Remainders
2	1679	
2	839	1
2	419	1
2	209	1
2	104	1
2	52	0
2	26	0
2	13	0
2	6	1
2	3	0
2	1	1
2	0	1

Write in this order

$1679_{10} = 11010001111$

(iv) 1235_{10}

Repeated Division		Remainders
2	1235	
2	617	1
2	308	1
2	154	0
2	77	0
2	38	1
2	19	0
2	9	1
2	4	1
2	2	0
2	1	0
2	0	1

Write in this order

1235_{10} = 10011010011

(e) (i) 111001_2

32	16	8	4	2	1
× 1	× 1	× 1	× 0	× 0	× 1
32	16	8	0	0	1

32 + 16 + 8 + 0 + 0 + 1 = 57

Hence, $111001_2 = 57_{10}$

(ii) 1010101_2

64	32	16	8	4	2	1
× 1	× 0	× 1	× 0	× 1	× 0	× 1
64	0	16	0	4	0	1

64 + 0 + 16 + 0 + 4 + 0 + 1 = 85

Hence, $1010101_2 = 85_{10}$

(iii) 110110_2

32	16	8	4	2	1
× 1	× 1	× 0	× 1	× 1	× 0
32	16	0	4	2	0

32 + 16 + 0 + 4 + 2 + 0 = 54

Hence, $110110_2 = 54_{10}$

(iv) 111011_2

32	16	8	4	2	1
× 1	× 1	× 1	× 0	× 1	× 1
32	16	8	0	2	1

32 + 16 + 8 + 0 + 2 + 1 = 59

Hence, $111011_2 = 59_{10}$

2. Fill in the blanks:

(a) Decimal number system

(b) words, number

(c) Binary number system

(d) 1, 0

(e) Bit

(f) Base-8 number system

(g) Hexadecimal number systems

3. Match the following:

(a) (iv) Decimal number system

(b) (viii) Octal number system

(c) (x) Hexadecimal number system

(d) (i) Binary number system

(e) (ii) 11001000_2

(f) (ix) 100110_2

(g) (iii) 27_{10}

(h) (v) 1101_2

(i) (vii) 1010100_2

(j) (vi) 10010_2

4. Write T for true and F for false statements:

(a) F (b) F (c) F (d) T (e) T

(f) F (g) T

5. Tick (✓) the correct option:

(a) (ii) $(1100000110)_2$

(b) (i) Base-10 system

(c) (iv) Repeated division method

(d) (i) $(1011001)_2$

(e) (i) $(44)_{10}$

(f) (ii) $(1111010100)_2$

(g) (iii) $(92)_{10}$

6. Application-based Questions

(a) Computers use binary numbers instead of decimal numbers because they operate with electrical signals that have only two states: ON (1) and OFF (0). This allows them to process and store information more easily, quickly and reliably.

(b) Calculators use number systems to perform calculations efficiently. They take input in decimal, convert it into binary for processing, carry out calculations using binary arithmetic and then convert the result back into decimal for display. This ensures quick and accurate results.

(c) Sneha can make her secret code more complex by using different number systems like binary, octal and hexadecimal. She can mix them, apply mathematical tricks like adding or subtracting numbers or create custom patterns to make decoding harder. These techniques will help her design a fun and challenging secret code.

(d) Computers store data as 0s and 1s (binary). Data like text, photos and videos is converted into this form and saved in memory. When Anil transfers data, it remains in binary to keep it safe and readable.

(e) Steps to find the decimal equivalent of the binary number 1101 are as follows:

(i) Write the binary number with place values (starting from right, powers of 2).

$1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

(ii) Calculate each term.

$1 \times 8 + 1 \times 4 + 0 \times 2 + 1 \times 1$

(iii) Add the values.

$8 + 4 + 0 + 1 = 13$

So, the decimal equivalent of 1101 (binary) is 13 (decimal).

Chapter 2
Advanced Features of Excel

1. Answer the following questions:

(a) Sorting means arranging the data in an ordered sequence in a systematic manner so that the analysis can be done easily.

(b) We can sort the columns in two ways:

(i) Ascending – Sorting is done from A-Z

Home tab→ Editing group→ Sort & Filter→ Sort A to Z

(ii) Descending – Sorting is done from Z-A

Home tab→ Editing group→ Sort & Filter→ Sort Z to A

(c) Following options available in Print pane to print worksheet are:

- Number of copies
- Which sheets to be printed
- Name of the printer
- Size of the page
- Orientation
- Margins
- With or without Scaling

(d) Excel provides an interesting feature using which we can view rows of data (records) that suit a specified selection criterion. This feature is called filtering data. We can filter records from an identified range of data by defining a filter condition.

(e) When we know the result and want to know the input value, at that time the Goal Seek feature is used. Therefore, we can say that goal seeking is the process of finding the correct input value when only the output is known.

2. Fill in the blanks:

(a) Backstage

(b) Set cell

(c) Advanced filter

(d) (i) Ascending

(ii) Descending

(e) Sort & Filter group → Clear option

3. Match the following:

(a) (viii) A to Z sorting

(b) (ix) Z to A sorting

(c) (iii) Sorting with multiple columns

(d) (vii) Rows with specified selection criteria

(e) (vi) What if analysis

(f) (iv) Sort and Filter group

(g) (v) Backstage

(h) (i) CTRL + SHIFT + L

(i) (ii) Forecast group

4. Write T for true and F for false statements:

(a) F (b) F (c) T (d) T (e) T

(f) T (g) T (h) T (i) T

5. Tick (✓) the correct option:

(a) (iv) Formulas

(b) (iii) Multiple

(c) (iii) For value

(d) (i) Goal Seek

(e) (i) Backstage

(f) (i) Ascending order

(g) (ii) Criteria

(h) (iv) Auto

(i) (i) Goal Seek

6. Application-based Questions

(a) Sorting

(b) Filtering Data

(c) By applying filter on the dataset

(d) Raj can use (multiple) Sort feature in Excel to arrange his dataset first by age and then by city.

(e) Goal Seek

Chapter 3
Charts in Excel

1. Answer the following questions:

(a) Charts are used to represent data in a graphic form. Charts are also called graphs. Charts are visually more appealing and make it easy for us to analyse and compare trends in data.

When we display information in charts and graphs, it is easier to understand and interpret the data. This makes the reporting process much easier and meaningful. We can present and analyse the information in a much more efficient manner.

(b) (i) **Titles** – The title should be such that it can clearly describe the purpose of the chart.

(ii) **Horizontal Axis** – It is the x-axis of the graph. Horizontal axis of the chart is also known as category axis.

(iii) **Legends** – It displays the colour representation of each data series in the chart.

(iv) **Data Series** – Related data points on the chart form the data series.

(v) **Vertical Axis** – It is the y-axis of the graph. Vertical axis of the chart is also known as value axis.

(c) Steps for creating a chart:

The first step is to collect the data for which we want to create a chart. We will have to do the following steps to make a chart using this data.

(i) Select the complete data range, including the column headings and row labels. This is our source data.

(ii) Open the Insert tab and locate Charts group on the ribbon.

(iii) The Charts group provides different types of charts.

(iv) Select the desired chart category from the Charts group.

(v) Click on the arrow below the selected chart category to select the chart type. Each chart category has different chart types.

(vi) Select the desired chart type from the drop-down menu.

(vii) The chart will appear in the excel sheet.

(d) Two chart tabs added to the ribbon when we insert charts to MS Excel sheet:

(i) Design tab

After creating a chart, we can change its look by using the predefined options provided by MS Excel. Following groups appear under Design tab:

- *Chart Layouts* – Help change the chart layout.
- *Chart Styles* – Various chart styles options are displayed in this group. We can change the chart style as per our need.
- *Data* – Allows us to switch between row and column using the same data. Select Data button opens the Select Data Source dialog box where we can interchange and add new entries to the source data.
- *Type* – Helps change the chart type.
- *Location* – Allows us to move the chart to different location.

(ii) Format tab

Under this tab, formatting of the chart can be done. It provides the following groups:

- *Current Selection* – Used for formatting the chart area.
- *Shape Styles* – Provide style to the line or shape, fill solid colour and outline to the shape. Can also give special effects to the shapes.
- *WordArt Style* – Provides WordArt styles to the text.
- *Arrange* – Helps in arranging the chart data.
- *Size* – Helps in changing the height and width of the chart.

2. Fill in the blanks:

(a) Charts
(b) Insert
(c) Design, Format
(d) Switch Row/Column
(e) Quick Layout
(f) Fill & Line, Effects, Series Options
(g) Fill & Line, Effects, Size and Properties, Axis Options
(g) Move Chart

3. Write T for true and F for false statements:

(a) T (b) T (c) F (d) T (e) F
(f) T (g) F

4. Tick (✓) the correct option:

(a) (ii) Graphic form (b) (iii) Category axis
(c) (i) Data Series (d) (iv) All of these
(e) (i) Quick Layout option (f) (iv) Data Series
(g) (iv) Series Options

5. Application-based Questions

(a) (i) Select the dataset of student marks.
(ii) Go to Insert tab in Excel and locate Charts group on the Ribbon.
(iii) Choose a suitable chart type from Charts group.
(iv) The selected chart will appear in the worksheet.
(b) Chart Design
(c) (i) Select the chart to change its type.
(ii) Open Chart Design tab and locate Type group.
(iii) Click Change Chart Type option from this group.
(iv) In Change Chart Type window, select Pie Chart.
(v) Click OK and the chart will be updated.
(d) Bar Chart
(e) Line Chart

Chapter 4
Internet—HTML

1. Answer the following questions:

(a) When we use a browser software and enter a website address, we are requesting for access to information that is published on the site. The computer which is requesting is called a 'client computer' and the computer that is providing the information is called the 'server'. When we ask a question to our teacher, we are requesting for information, thus we are a client and teacher who is answering our question and is giving us information is the server.

(b) Some of the important features of HTML are as follows:

- Creates a web page using tags.
- Uses graphics and display text in different fonts, sizes and colour.
- Enhances the presentation of the document using HTML elements.
- Creates hyperlinks to navigate to different documents present on the web.
- Displays data in a tabular form.
- Creates multiple windows on a web page.

(c) In HTML, the syntax used is called Tags.

Tags are enclosed within angular brackets: < and >. There are many predefined tags in HTML, which are used for specific purposes while writing programs. The programs that we create using HTML, when called using a browser, are called HTML documents. HTML programs are created with the help of, these tags. Tags start or open with <….> and end or close with </….>.

These tags define the type of document.

(d) There is a specific structure that needs to be followed while writing a program in HTML. This structure is defined by the World Wide Web Consortium. Example of a standard structure that needs to be followed is given below:

```
<HTML>
        <HEAD>
            <TITLE>
            <!Window title is written here-->
            </TITLE>
        </HEAD>
        <BODY>
        <!—Page content is written here-->
    </BODY>
    </HTML>
```

Each HTML program should have the following tags:

- <HTML> ……</HTML> : <HTML> tag helps the browser to know that the HTML code starts from here and </HTML> tag tells the browser that the HTML code ends here in the program.
- <HEAD> ……</HEAD> : This indicates the first part in HTML code. It contains the title tag.
- <TITLE>…….</TITLE> : This helps us in writing the Title of the document. It gets displayed on the title bar of the window.
- <BODY> ……</BODY> : This is the main part of our HTML document. The contents of the page are written within this tag.

(e) Tags are of two types:

- **Paired tags**–A tag is said to be a paired tag if the text is placed between a tag and its companion tag. In paired tags, the first tag is referred to as Opening Tag and the second tag is referred to as Closing Tag.

  For example,

  <H>Heading of a document </H>
- **Unpaired tags**–An unpaired tag does not have a companion tag. Unpaired tags are also known as Singular or Stand-Alone Tags.

  For example,

 <hr>

(f) (i) Short form of a web browser is a browser. A browser is a software application used to locate, retrieve and display content on the World Wide Web.

It includes web pages, images, video and other files. As a client/server model, the browser is the client run on our computer. It contacts the web server and requests for the information. The web server sends the information back to the browser, which displays the results on our computer screens.

(ii) Web page: A web page is a document or a page on the World Wide Web (www). Each web page has its unique URL. It consists of information in the form of text, images, audio, videos and hyperlinks.

(iii) Website: A website is a collection of related web pages. With the help of a web browser, we can open websites.

2. Fill in the blanks:

(a) Web pages

(b) <HTML>

(c) <HEAD>…</HEAD>

(d) Title bar

(e) Hypertext Transfer Protocol (HTTP)

3. Tick (✓) the correct option:

(a) (iii) <H3> text heading </H3>

(b) (ii) 6 levels

(c) (ii) META
(d) (v) BORDER
(e) (ii) Google Chrome
(f) (i) SUBSCRIPT
(g) (iv) <P>...</P>
(h) (iii) <Head>...</Head>
(i) (iv)
(j) (iii) <META> and <TITLE>

4. Match the following:

(a) (vii) Client
(b) (iv) Server
(c) (v) Protocol
(d) (vi) Web pages
(e) (i) HTML
(f) (viii) Tag with angular brackets
(g) (x) <BODY>...</BODY>
(h) (ix) Cascading Style Sheets
(i) (ii) Line break tag
(j) (iii) Paragraph tag

5. Write T for true and F for false statement:

(a) T	(b) T	(c) F	(d) T	(e) F
(f) F	(g) T	(h) T	(i) F	(j) T

6. Application-based Questions

(a) HTML: HyperText Markup Language
(b) CSS: Cascading Style Sheets
(c) Heading tag: <H1>
(d) Anchor tag: <A>
(e) BGCOLOR

Chapter 5
The World of Canva

1. Answer the following questions:

(a) Canva is a free online design platform that helps us create beautiful graphics, presentations, posters and much more without needing to be artists or having expensive software. It is particularly beneficial for students because:

- It is free of cost for most features.
- It is easy to learn with simple tools.
- It provides thousands of ready-made templates for school projects.
- We can access it from any device (computer, tablet or smartphone).
- We can collaborate with classmates on projects.
- It is perfect for creating presentations, posters and assignments.

(b) The three main sections are:

1. Top Pane: This contains the search feature "What will you design today?", the option to upgrade to Canva Pro, a search bar to find specific templates, and tabs for Our designs, Templates and Canva AI.
2. Left Pane: This has key navigation options including Create (to start new designs), Home (main dashboard), Projects (saved designs), Templates (pre-made designs), Brand, Canva AI, Apps, Uploads (our images), and Trash (deleted designs).
3. Center Pane: This gives quick access to different design types we can create such as Presentation, Poster, Flyer, Social Media, Video, Doc, Sheet, Whiteboard, and Website.

(c) The three main font families are:

1. Serif fonts (like Times New Roman): These are good for formal documents and have small decorative lines at the ends of letters.
2. Sans-serif fonts (like Arial): These give a clean, modern look for projects and do not have decorative lines.
3. Decorative fonts (like Lobster): These are creative and fun fonts used for titles and creative projects.

(d) Primary colors are the basic colors that cannot be made by mixing other colors. They are:

- Red
- Blue
- Yellow

Secondary colors are made by mixing two primary colors together. They are:

- Green (Blue + Yellow)
- Orange (Red + Yellow)
- Purple (Red + Blue)

(e) The steps to download a design as PDF are:

1. Click on the Share button
2. Select Download from the options
3. Choose PDF as the file type (PDF is best for printing in high quality)
4. Click on Download
5. The file will be saved to our device

2. Fill in the blanks:

(a) Free
(b) Primary, secondary
(c) Uploads
(d) Crop
(e) Complementary
(f) Letter spacing
(g) Whiteboard
(h) Blue
(i) Transparency
(j) automatically

3. Match the following:

(a) (iv) Multiple slides for projects
(b) (v) Eye-catching wall display for classroom
(c) (ii) Like Excel but colorful for planning
(d) (iii) Like Word document for reports
(e) (i) Digital collaborative space

4. Tick (✓) the correct option:

(a) (ii) Green

(b) (ii) Makes text stand out

(c) (iii) Brightness

(d) (ii) Gradients

(e) (iii) Red

(f) (iii) Elements

(g) (ii) PDF

(h) (ii) Removes unwanted parts

(i) (ii) 3–4

(j) (iii) Line spacing

Chapter 6
Database and DBMS—An Introduction

1. Answer the following questions:

(a) A database is an organized collection of structured information, or data, typically stored electronically in a computer system.

(b) RDBMS stands for Relational Database Management System. RDBMS is a type of DBMS in which the database is organized and accessed according to the relationship between data values of fields in tables. Tables in the database are related to each other with the help of a common identified field. The connection between such tables is called **relation**. Access 365 is an example of RDBMS.

(c) Following are the contents of a table:

- **Data Fields:** Columns are known as data fields or just fields. Each field contains data of one type. It is a good practice to name the field according to the data it will hold. For example, in a students table, we can have fields like Roll Number, Student's Name, Class and Section which are self-explanatory.
- **Records:** Data in a single row is known as a record. A record gives complete information about a unit. For example, a record gives details of a student.
- **Data Item:** Data stored in one cell is known as a data item. All the data items in a single row form a record.
- **Primary Key:** The column 'Roll Number' has unique values. No two students can have the same roll number in a school. It is important to have a field that uniquely identifies a record in a table. A field that stores such unique values is termed as the Primary Key field. Once we define a field as a primary key, Access ensures no two data items in that field can contain the same value in that table.

(d) **Primary Key**—In a table, we should have one or more fields whose value(s) uniquely identify a record. Such a field (or set of fields) is known as the Primary key for a table. Primary key cannot have a null value (undefined value).

Primary Key	Foreign Key
Primary key uniquely identifies a record in a table.	Foreign key is a field in the table, that is, primary key in another table.
Primary key can't accept null values.	Foreign key can accept multiple null values.
We can have only one primary key in a table.	We can have more than one foreign key in a table.

(e) Access provides us with an important feature which helps us in retrieving data from one or more tables. We can write a query statement by providing select or search conditions to get the desired data from multiple tables.

Queries are of the following types:

(i) Simple Query: Simple query is the select query. It gets data from one or more tables and the result is displayed in datasheet view.

(ii) Crosstab Query: Used for calculation and restructuring of data for better analysis.

(iii) Find Duplicates Query: This query finds duplicate records within a single table or previously created query.

(iv) Find Unmatched Query: This query is created to find records in one table that do not match records in a related table.

(f) (i) **Form**—Form is a graphical representation of a table. We can add, update and delete records in a single table or multiple tables using a form. We can manipulate the same information either through forms or directly in the table. If we change a record in a form, it will be changed in the table. Data is stored in a table and form is just a graphical representation of that. Form displays only one record on the screen while the navigation button is there to retrieve all records.

(ii) **Queries**—Access provides us with an important feature which helps us in retrieving data from one or more tables specified by some conditions. We can write a query statement by providing select or search conditions to get desired data from multiple tables.

(iii) **Table**—Access allows us to have one or more related tables in a database. Every table must have a table name. Following are the contents of a table:

- *Data Fields:* Columns are known as data fields or just fields. Each field contains data of one type. It is a good practice to name the field according to the data it will hold. For example, in a students table, we can have fields like Roll Number, Student's Name, Class and Section which are self-explanatory.

- *Records:* Data in a single row is known as a record. A record gives complete information about a unit. For example, a record gives details of a student.
- *Data Item:* Data stored in one cell is known as data item. All the data items in a single row form a record.

(iv) **Report**—A report is an effective way of presenting data as information either on screen or in a printed format. We can arrange the fields on the report and can display the information the way we want to see it.

(v) **Master Table** – A master table is a table which holds a single record for an entity. The data is relatively permanent in a master table.

(vi) **Transaction Table** – In a transaction table, multiple records of same data can exist. The transactions are the activities performed on the master tables. These activities are recorded in the transaction tables.

(vii) **Referential Integrity** – Referential Integrity is a system of rules that ensures that relationships between related tables are valid and no records are deleted or changed accidentally.

2. Fill in the blanks:

(a) Data redundancy
(b) Relational Database Management System
(c) Reports
(d) Data item, record
(e) Primary key
(f) Foreign key
(g) .ACCDB
(h) Redundancy, inconsistency
(i) Form, tables
(j) Navigation pane
(k) Datasheet

3. Tick (✓) the correct option:

(a) (i) DBMS
(b) (ii) Authorization Check
(c) (i) Storage containers
(d) (iv) Forms
(e) (iv) Referential Integrity
(f) (ii) Relationship Section and Selection Criteria Section
(g) (iii) Data Field, Data item, Records
(h) (i) Query
(i) (iv) Defining purpose of database

4. Application-based Questions

(a) Team_ID or Team_Name

(b) Product_ID, Product_Name, Price, Quantity, Brand_Name, Supplier

(c) Book_Name or Book_ID or ISBN_Code or Book_Code

(d) Simple Query

(e) With the help of foreign key and by establishing one-to-many relationship between these two tables.

Chapter 7
Program Coding

1. Answer the following questions:

(a) (i) **Code:** Computer code, also known as program code, is the set of instructions written in any programming language. A computer can execute this code or program.

(ii) **Program:** A computer program is a sequence of instructions written using a Computer Programming Language to perform a specified task by the computer.

(iii) **Programming Language:** Specially designed languages used to write the commands are known as Programming languages. These languages help us to communicate with the computer language, *i.e.*, the machine language. The various programming languages, some of which are in use today, are BASIC, QBASIC, Visual Basic, C, C++, VC++, Java, etc.

(iv) **Execute:** Execution is a process by which we can execute the programs to obtain the desired result.

(b) Programming involves the following activities:

(i) Problem analysis

(ii) Understanding of the problem

(iii) Generating algorithms

(iv) Implementation, *i.e.*, coding of algorithms in a target programming language

(v) Testing

(vi) Maintenance

(c) The basic components of a program are:

(i) Identifiers (ii) Literals

(iii) Data types (iv) Operators

(v) Loops (vi) Decision-making

(d) Naming conventions are the set of rules for choosing the character sequence to be used for identifiers. Following are the naming conventions to be followed:

(i) The first character must be a letter.

(ii) Names can have alphabet and numbers in any sequence.

(iii) The underscore (_) counts as a letter.

(iv) The alphabet or names cannot contain a space.

(v) Upper case letters are different from lower case letters, *i.e.*, it is case-sensitive.

(vi) Identifier name cannot start with a number.

(vii) The name cannot contain special characters other than A-Z, a-z or underscore.

(viii) Keywords cannot be used in names. Keywords are the special words which are reserved and have special meaning.

(e) Literals are the constants that never change their value during program execution. Literals are of the following types:

(i) **Boolean:** Boolean means the value is either true or false. True means 1 and False means 0.

For example:

X = False

Where X is a variable and false is a constant.

(ii) **Integer:** Integer constants are whole numbers. The integer constant cannot have decimal values.

For example:

X = 4

Where X is a variable and 4 is a constant.

(iii) **Character:** Character constants can contain only one character, enclosed within single quotes.

For example:

X = 'a'

Where X is a variable and 'a' is a constant.

(iv) **Floating:** These are also known as real constants because these numbers can be in decimal. Real constant must have at least one digit before decimal and one digit after decimal.

For example:

X = 4.6

Where X is a variable and 4.6 is a constant.

(v) **String:** String constants are multi characters, enclosed within double quotes.

For example:

X = "Computer"

Where X is a variable and "Computer" is a constant.

(f) What is a function and why do we use functions in programming?

Function: A function is like a recipe that has a name and contains a set of instructions to perform a specific task. Just as a recipe has step-by-step instructions to make something, a function contains code that tells the computer to perform a particular task.

Why we use functions:

1. Save time: Instead of writing the same code many times, we write it once in a function and use it whenever needed.
2. Easy to remember: A simple function name helps us understand what it does.
3. Reusable: We can use the same function in different parts of our program.
4. Reduces redundancy: Functions help us keep our code DRY (Don't Repeat Yourself).
5. Increases readability: Makes code organized and easy to understand.
6. Reduces code length: Removes repetitive code and replaces it with function calls.
7. Minimizes errors: Writing code once means fewer chances of making mistakes.

Example: Instead of writing "Hello! Welcome!" every time we want to greet someone, we create a greet() function and just call it whenever needed.

(g) Explain the difference between an event and an event handler with a real-world example.

Event: An event is something that happens on a computer or in a program. It's like a signal that tells the program "Hey, something just happened!" Events include actions like clicking a button, typing on keyboard, moving mouse, etc.

Event Handler: An event handler is like a helper that waits for an event to happen. When the event occurs, the event handler runs specific code to respond to that event.

Real-world Example–Doorbell System:

- Event: Someone rings the doorbell
- Event Handler: You go and open the door

When someone presses the doorbell button (event), you hear the ring and respond by opening the door (event handler executing its task).

Computer Example - Game Character:

- Event: Player presses the spacebar key
- Event Handler: Code that makes the character jump

When you press spacebar (event happens), the character automatically jumps on screen (event handler runs the jump code).

Another Example - TV Remote:

- Event: Pressing the volume button on remote
- Event Handler: TV increases/decreases the volume

The button press is the event, and the TV responding by changing volume is the event handler in action.

2. Fill in the blanks:

(a) Data types are of two types:
  (i) Fundamental
  (ii) Derived

(b) Computer memory locations

(c) Initializing

(d) Reliable, robust, usable, portable

(e) Operators are of the following types:
  (i) Arithmetic
  (ii) Relational
  (iii) Logical

(f) Modulus

(g) Logical

(h) NOT

(i) Assignment

(j) Compilation

(k) array, data, index

(l) DRY, short

3. Write T for true and F for false statements:

(a) F (b) T (c) F (d) T (e) F

(f) F

4. Match the following:

(a) (iv) Problem-solving technique

(b) (v) =

(c) (vi) !

(d) (vii) &&

(e) (viii) ||

(f) (ix) >=

(g) (x) %

(h) (ii) *

(i) (i) /

(j) (iii) Numbers with decimal point

5. Tick (✓) the correct option:

(a) (i) 1

(b) (ii) Single

(c) (iii) Initialize

(d) (i) =

(e) (ii) >=

(f) (i) 24goodnews

(g) (iii) Problem-solving

(h) (ii) 0

(i) (iii) Makes code run slower

(j) (ii) The key creates an event

6. Application-based Questions

(a) Relational/Comparison Operator

(b) Looping Statements: *for* or *while*

(c) Decision-making/Conditional Statements: *if, elif* or *else*

(d) Arithmetic Operator (Modulus %)

(e) *for* loop

7. Machine Room Exercise:

(a)

```
Begin
Numeric percentage
In put percentage
If percentage > 95%
        Display "Grade A1"
Else if percentage < 94 && percentage > 85
        Display "Grade A"
Else if percentage < 84 && percentage > 75
        Display "Grade B1"
Else if percentage < 74 && percentage > 65
        Display "Grade B"
Else if percentage < 64 && percentage > 55
        Display "Grade C1"
Else if percentage < 54 && percentage > 45
        Display "Grade C"
Else if percentage < 44 && percentage > 35
        Display "Grade D"
```

```
Else if percentage < 34
        Display "Grade F"
End
```

(b)

```
Begin
Numeric Age
Input Age
If the Age >= 14
        Display "Yes, The user is the student of class VIII."
Else
Display an error message.
```

(c)

```
Begin
Numeric Num1, Num2
Input Num1, Num 2
If Num1 = Num2
        Display "Num1 and Num2 are equal"
Else if Num1 > Num2
        Display "Num1 is greater than Num2"
Else
        Display "Num2 is greater than Num1"
End
```

(d)

```
Begin
Numeric WeekNum
Input WeekNum
If WeekNum = 1
        Display "Monday"
If WeekNum = 2
        Display "Tuesday"
If WeekNum = 3
        Display "Wednesday"
If WeekNum = 4
        Display "Thursday"
If WeekNum = 5
        Display "Friday"
If WeekNum = 6
        Display "Saturday"
If WeekNum = 7
        Display "Sunday"
End
```

Chapter 8
More about Python

1. Answer the following questions:

(a) Python is a general-purpose programming language that can be used to build any kind of program. It is very simple, flexible and easy to understand. Python is widely used across platforms. It is used to build not only desktop applications, web applications but also mobile applications.

(b) Comment is the text added by the programmer while writing a code. Proper comments make code maintenance easier. They generally tell about the function of the code written. The compiler ignores these lines at the time of execution.

(c) Python has defined some rules to name a variable. These are as follows:

(i) A variable name must start with a letter or the underscore character.

(ii) A variable name cannot start with a number.

(iii) A variable name can only contain alpha-numeric characters and underscores (a-z, 0-9, and _).

(iv) Variable names are case-sensitive (age, Age and AGE are three different variables).

(d) Operators are used to perform various operations on variables and values.

Operators in Python are of the following types:

(i) **Arithmetic Operators:** Arithmetic operators are used with numeric values to perform mathematical calculations. For example, x + y.

(ii) **Assignment Operators:** Assignment operators are used to assign values to the variables. For example, x = 5.

(iii) **Comparison Operators:** Comparison operators are used to compare values. For example, x > y.

(iv) **Logical Operators:** Logical operators are used to combine two or more conditional statements. For example, x < 5 AND x < 10.

(v) **Identity Operators:** Identity operators compare the memory locations of two objects. For example, x is y.

(vi) **Membership Operators:** Membership operators are used to find out whether a value is a member of a sequence such as string or list. For example, x in y.

(vii) **Bitwise Operators:** Bitwise operators are used to compare binary numbers.

(e)

Identity Operator	Membership Operator
Identity operators compare the memory locations of two objects.	Membership operators are used to find out whether a value is a member of a sequence such as string or list.
Operator – is, is not	Operator – in, not in

2. Fill in the blanks:

(a) Variables
(b) Equal to sign (=)
(c) Comments
(d) Indentation
(e) .py or .pyw
(f) general-purpose
(g) String
(h) Arithmetic
(i) Modulus
(j) Assignment

3. Match the following operators:

(a) Arithmetic operators (+, –, *, ? %, **, //)
(b) Assignment operators (=, +=, –=)
(c) Comparison operators (==, !=, >, <, >=, <=)
(d) Logical operators (and, or, not)
(e) Identity operators (is not)
(f) Membership operators (in, not in)

4. Write T for true and F for false statements:

(a) T (b) F (c) T (d) F (e) T
(f) T

5. Tick (✓) the correct option:

(a) (iii) is
(b) (i) ==
(c) (iv) Logical
(d) (iv) =
(e) (i) Increment the values with the value specified after = symbol.
(f) (ii) Removed
(g) (ii) Modulus
(h) (ii) True
(i) (ii) A variable name can start with a number

6. Application-based Questions

(a) Python
(b) #
(c) By using modulus % operator to check the divisibility.
(d) Relational/Comparison Operator
(e) Text type – str

Chapter 9
Types of Artificial Intelligence

1. Answer the following questions:

(a)

Strong AI	Weak AI
It can do anything that a human can do.	It can only focus on a few tasks at hand.
It learns from its own experience and makes its own decisions.	It follows human commands and rules for a specific purpose.
It has self-awareness and is conscious because of which it can understand and interact with other beings.	It does not have human consciousness although it may be able to simulate it sometimes.
It does not exist yet in the real world but only in fiction.	It exists today in phones, cars, TVs, games, etc.

(b) Artificial Intelligence can be classified based on the following factors:

(a) Complexity or capabilities

(b) Functionality

(c) Here are some examples of Weak AI:

- A voice-recognition software
- An email spam filter
- A self-driving car
- A chess-playing program.

(d) (i) **Reactive machines:**

- These are the simplest type of AI.
- They only react to what is happening right now.
- They do not remember anything from the past or plan anything for the future.
- They just follow a set of rules to do a specific task

(ii) **Limited-memory machines:**

- These are machines that can store some information for a short period of time.
- They use this information to improve their performance.
- For example, a self-driving car is a limited-memory machine. It can remember things like the speed and distance of other cars, traffic lights and road signs. It uses this information to drive safely and smoothly.

(iii) **Theory-of-mind machines:**

- These are machines that can understand the thoughts and feelings of other beings.
- They can interact with them in a natural and social way.
- For example, a robot that can talk to a human and understand their emotions is a theory-of-mind machine. It can also express its own emotions and preferences.

(iv) **Self-aware machines:**

- These are machines that can be aware of themselves and their surroundings.
- They can have their own goals and opinions.
- They can also learn from their experiences and improve themselves.
- For example, a robot that can recognize itself in a mirror and make decisions based on its own interests is a self-aware machine.

(e) Some fictional examples of Strong AI are:

(i) HAL 9000 from the movie *2001: A Space Odyssey*.

HAL 9000 is a supercomputer that controls the spaceship and communicates with the crew.

(ii) WALL-E from the movie *WALL-E*.

WALL-E is a robot that collects and compacts trash on the earth after humans have left the planet.

2. Fill in the blanks:

(a) Artificial General Intelligence (AGI) or Generalized AI
(b) intellectual
(c) Narrow AI
(d) weak
(e) HAL 9000, WALL-E
(f) Limited-memory machines
(g) Theory-of-mind machines
(h) Self-aware machines

3. Write T for true and F for false statements:

(a) T (b) T (c) F (d) F (e) T
(f) F (g) F (h) T

4. Tick (✓) the correct option:

(a) (i) A calculator that can perform mathematical functions quickly.
(b) (iv) All of these
(c) (i) Reactive
(d) (ii) Limited-memory
(e) (iii) Theory-of-mind
(f) (iv) Self-aware

(g) (ii) It can follow human commands and rules for a specific purpose.

(h) (i) They can perform tasks faster and more accurately than humans.

(i) (ii) A calculator that can perform mathematical calculations quickly.

6. Application-based Questions

(a) Weak AI or Narrow AI

(b) Strong AI

(c) Theory-of-mind machines

(d) If robots could do everything, life would be very different. People would have more time for fun and learning. Robots would help in schools, hospitals and even make art and music. They would also keep us safe. However, there might be risks like hacking.

(e) AI should be fair, safe and clear. Humans must control it, protect privacy and use it for the good of society.

Chapter 10
Latest Technologies–The Game Changer

1. Answer the following questions:

(a) (i) **Virtual Reality:** It is a simulated 3D digital world that we can explore, such as a video, a game or a simulation system, by wearing a VR headset or head-mounted display to get a 360-degree view of an artificial world that makes our brain believe that we are in a different reality.

(ii) **Extended Reality:** Technologies that can create, alter or enhance the perception of reality by using computer-generated simulations, models or environments are known as Extended Reality (XR).

(iii) **Augmented Reality:** It is a technology that adds digital information, like images, sounds or videos to the real world around you, by making use of devices like smartphones, tablets or special glasses to superimpose this extra content onto what you see in real life.

(iv) **Mixed Reality:** Mixed Reality (MR) is a technology that blends both the real world and the digital world together, allowing them to interact with each other. It allows us to manipulate virtual objects in the real world or see real objects in a virtual environment.

(b)

Virtual Reality	Augmented Reality
It completely replaces the real world with a virtual one.	It adds virtual elements to the real world.
It can be experienced through VR headsets or goggles.	It can be experienced through smartphones, tablets or AR glasses.
We can see only a computer-generated, virtual world.	We can see both the real world and digital objects are superimposed.
There is no interaction with the real world.	It helps us interact with and enhance the real world.
For example, playing a game where you feel like you are inside the game world.	For example, using an app to see a virtual animal walking on your desk.

(c) Virtual Reality (VR) is used in the following fields:

(i) **Education:** VR can make learning more interactive and effective by allowing us to access information, visualize concepts or practise skills. For example, Google Expeditions (however this is not in use anymore), Body VR, etc.

(ii) **Healthcare:** VR improves healthcare by enhancing diagnosis, treatment, training and therapy. For example, Psious, virtual reality medical centre, etc.

(iii) **Gaming:** VR can make games more interactive and engaging by allowing us to explore virtual world or interact with digital characters. For example, *Half life: Alyx2, Beat Saber3,* etc.

(iv) **Tourism:** VR can enhance the travel experience by allowing us to visit distant places, learn about cultures or discover new attractions. For example, Google Earth VR, Ascape VR, etc.

(d) Augmented Reality (AR) is used in the following fields:

(i) **Education:** AR can make learning more engaging and interactive by providing personalized content. For example, exploring historical sites, viewing 3D models of human anatomy, etc.

(ii) **Healthcare:** AR can improve the quality and efficiency of healthcare services by providing accurate and timely information. For example, visualizing medical images, monitoring patients' health, etc.

(iii) **Gaming:** AR allows us to interact with digital characters and we can explore the real world. For example, Pokémon Go, Harry Potter: Wizards Unite, etc.

(iv) **Tourism:** AR can enrich the travel experience and cultural awareness by providing more information and interaction. For example, virtual tour guides, AR maps, etc.

(e)

Virtual Reality	Augmented Reality	Mixed Reality
Creates a completely virtual world.	Adds digital elements to the real world.	Blends the real world with interactive digital elements.
Experienced through VR headsets or goggles.	Experienced through smartphones, tablets or AR glasses.	Experienced through specialized headsets, glasses or AR devices.
No interaction with the real world.	You can still see and interact with the real world.	Real-world objects interact with virtual elements.
Only a computer-generated, virtual world.	Real world with digital objects superimposed.	A combination of real-world and digital elements, which interact with each other.
For example, VR gaming like Oculus Rift, virtual tours, etc.	For example, Pokémon GO, AR learning apps, etc.	For example, Microsoft HoloLens, AR-based industrial training, etc.

2. Fill in the blanks:

(a) virtual, augmented

(b) Microsoft HoloLens, Magic Leap

(c) 25%, 75%

(d) Augmented Reality

(e) Google Expeditions, Body VR

3. Match the following:

Virtual Reality	Augmented Reality
Ascape	Pokémon GO
Psious	Harry Potter: Wizards Unite
Google Expeditions	
Half-Life: Alyx	
Visualize medical images	
Navigate unfamiliar places	

4. Write T for true and F for false statements:

(a) F (b) F (c) T (d) T (e) F

(f) T

5. Tick (✓) the correct option:

(a) (ii) Extended Reality

(b) (i) Virtual Reality and Augmented Reality

(c) (iii) Headset

(d) (i) Smartphone

(e) (iv) All of these

(f) (i) Pokémon GO

(g) (iv) XR

(h) (iii) MR

6. Application-based Questions

(a) Virtual Reality

(b) Augmented Reality

(c) Virtual Reality

(d) Ankit can use Extended Reality (XR) to visualize and test his product before manufacturing by creating a 3D model using Virtual Reality (VR) and Augmented Reality (AR).

(e) Rachit is having an immersive Virtual Reality (VR) experience. The VR headset makes him feel like he is inside the game, allowing him to see, hear and interact with the virtual world as if it were real.

Chapter 11
Exploring AI Domains—NLP And Statistical Data

1. Answer the following questions:

(a) Three main domains of AI: The three main domains of AI are Computer Vision (enables machines to see the world through cameras, images and videos), Natural Language Processing (enables machines to understand spoken and written human language), and Statistical Data (enables machines to understand and analyze large amounts of numerical data).

(b) How NLP works and its three key benefits: NLP works by feeding speech or text into a computer, which cleans the input to make it easier to process. The computer then uses learning-based AI to understand what we are communicating and provides appropriate responses.

The three key benefits are: It helps computers communicate with us in human language; it can analyze much more text and speech than humans without getting tired; and it provides responses based on understanding the context.

(c) Three real-world applications of NLP: Grammar and Spelling Correction tools like Grammarly review spelling, grammar and punctuation, helping us improve our writing. Autocomplete and Text Prediction features complete words we are writing or predict the next word based on our typing habits, saving time. Digital Assistants like Siri, Alexa and Google Assistant understand human language, answer general questions and offer suggestions based on our past activities.

(d) Importance of Statistical Data in AI: Statistical Data is important because it helps find hidden and unexpected patterns in large amounts of numerical information, visual representation makes complex data easier to understand, and its analysis helps in making better and more informed decisions. Real-world examples include COVID-19 vaccination planning, weather prediction and tourism growth analysis.

(e) Main ethical considerations in NLP and Statistical Data:

For NLP, the main ethical concerns are bias (both historical bias and representation bias), errors in understanding different accents and misspelled words, and difficulty understanding slang and informal language.

For Statistical Data, the key ethical considerations are transparency and explainability, fairness and being unbiased, privacy and data protection, accountability, and ensuring systems are safe, secure and sustainable.

2. Fill in the blanks:

(a) Language

(b) cameras

(c) numbers

(d) Grammarly

(e) Siri, Alexa and Google Assistant

(f) COVID-19/emergency

(g) Representation

(h) Transparent and explainable

(i) Privacy

3. Match the following:

(a) (iii) Images and videos processing

(b) (v) Understanding human language

(c) (i) Understanding numerical data

(d) (ii) Siri, Alexa, Google Assistant

(e) (iv) Grammar and spelling correction

(f) (vii) Wind speed and temperature analysis

(g) (vi) Historical and representation issues

(h) (ix) Text prediction based on typing habits

(i) (viii) Privacy and data rights

(j) (x) Healthcare emergency response

4. Multiple Choice Questions:

(a) (ii) Computer Vision

(b) (iii) Spoken or written language

(c) (iii) Grammarly

(d) (iii) Numbers

(e) (ii) Wind speed and temperature

(f) (iii) Non-technical people can understand AI decisions

(g) (ii) Privacy protection

(h) (iii) Statistical Data application

5. True or False:

(a) False

(b) True

(c) False

(d) False

(e) True

(f) False

(g) True

6. Application-based Questions:

(a) Smart Classroom Assistant: I would use all three AI domains together. NLP would help the assistant understand student questions by processing their spoken or typed queries and providing appropriate answers in natural language, similar to how digital assistants like Siri work. Computer Vision could analyze photographs of handwritten homework or drawings submitted by students, identifying errors or evaluating diagrams. Statistical Data could track each student's performance over time, identifying subjects where they struggle and generating progress reports, helping teachers personalize learning for each student.

(b) Hospital AI System: Computer Vision could analyze medical images like X-rays, MRI scans and microscope images to help doctors detect diseases more accurately and quickly. NLP could process patient records, doctor's notes and symptoms described by patients, helping in faster and more accurate diagnosis and also powering chatbots that guide patients. Statistical Data could analyze health trends across patients, predict disease outbreaks, manage hospital resources like beds and medicines, and plan for emergencies like COVID-19 more effectively.

(c) AI-Powered Library System: NLP would analyze students' reading history and preferences to suggest books they are likely to enjoy, and could also power a chatbot to help students search for books using natural language queries. Computer Vision could automatically scan book covers and barcodes to organize books into categories, track their location on shelves and identify damaged books. Statistical Data could track which books are most popular, identify reading trends across different age groups, and help the library decide which new books to purchase based on student interest patterns.

(d) AI for Farming Community: Computer Vision using drone cameras could monitor crop health by analyzing images of fields, detecting diseases, pest infestations or water stress early before they spread. NLP could analyze weather forecast reports, agricultural research articles and farming advice from experts, summarizing key recommendations in simple local language for farmers. Statistical Data could analyze historical weather patterns, soil conditions and crop yield records to predict the best time for planting and harvesting, helping farmers maximize their output while minimizing losses.

(e) AI Language Tutoring App: NLP would handle pronunciation correction by listening to students speak and comparing it with correct pronunciation patterns, while also checking grammar in written exercises and explaining mistakes in simple terms. Computer Vision could recognize handwritten characters in scripts like Hindi or Chinese, identify hand gestures used in sign language learning, and scan printed text for translation practice. Statistical Data would track each student's learning progress, identify their most common mistakes and weak areas, and personalize the difficulty level and type of exercises to match their individual learning pace and style.

Chapter 12
AI For Sustainability And Social Development

1. Answer the following questions:

(a) What is sustainability and why is it important for future generations? Provide the sandwich analogy explanation.

Sustainability means maintaining the world we live in so that natural resources can support future generations. The word comes from 'sustain', which means to maintain, support, withstand or endure.

The sandwich analogy explains this concept simply: Imagine you want to make a sandwich and need jam, but when you go to the kitchen, the jam bottle is empty. Your elder sister used it all in the morning. She says if she had known you would need jam later, she would have saved some for you. Similarly, our Earth has limited resources like land, water and food. If we use them all up or pollute them completely, there would be nothing left for coming generations. This is why we must act responsibly and save resources for the future.

(b) Explain the SDG Wedding Cake concept and list the three categories with their respective meanings.

The SDG Wedding Cake concept is a way to understand how the Sustainable Development Goals are interconnected. It divides the goals into three broad categories:

1. Biosphere (Foundation): Parts of Earth where life exists - this forms the base of the cake
2. Society (Middle layer): A group of people living together
3. Economy (Top layer): Production and consumption of goods and services

The concept states: "The economy must serve society within the resources provided by our Earth (Biosphere)." This means economic growth cannot come at the expense of society or the environment.

(c) What is systems thinking and how does it differ from traditional problem-solving approaches?

Systems thinking is a holistic approach to understanding and addressing complex problems. Instead of focusing on individual parts in isolation, it considers how various elements interact within a larger system to produce outcomes.

Key differences from traditional problem-solving:

- Systems thinking looks at interconnections, not just individual components
- It recognizes that systems behave differently than their individual parts
- It helps us avoid unintended consequences that straightforward solutions might create
- It considers feedback loops and time delays
- Examples include the water cycle, school systems, digestive system and food chains

(d) Describe how AI can be used as leverage in the coral bleaching case study.

In the coral bleaching case study, AI acts as leverage by helping protect coral reefs, which cover less than 1% of the ocean floor but are home to more than 25% of marine creatures. When temperatures rise or pollution increases, algae leave the reefs, causing coral to turn white.

AI can help in four main ways:

1. Predicting temperature changes that might cause bleaching before they happen
2. Monitoring pollution levels in real-time
3. Analyzing patterns to prevent future bleaching events
4. Helping authorities respond quickly to protect coral reefs

By providing predictive insights, AI helps decision-makers take action before damage occurs, making it a powerful leverage point in the system.

(e) List and explain three AI applications for environmental monitoring and their benefits.

1. Climate Change Monitoring: AI systems process satellite imagery, weather patterns and environmental sensor data to track climate changes in real-time and predict future environmental conditions. This helps us prepare for and respond to climate changes.

2. Biodiversity Protection: Machine learning algorithms help scientists identify endangered species, track animal populations and monitor ecosystem health through automated image and sound recognition. This makes conservation efforts more effective and efficient.
3. Smart Resource Management: AI optimizes energy consumption in smart cities, manages water distribution systems and reduces waste through intelligent routing and scheduling systems. This leads to more efficient use of resources and reduced waste.

These applications demonstrate how technology bridges human innovation and environmental care.

2. Match the following:

(a) (ii) Maintaining the world for future generations
(b) (i) 17 goals by United Nations
(c) (iv) Holistic approach to complex problems
(d) (iii) Parts of Earth where life exists
(e) (vi) Visual representation of system relationships
(f) (vii) Increase in X leads to an increase in Y
(g) (v) Chains of causes and effects
(h) (ix) Environmental stress response in reefs
(i) (viii) Best opportunity to affect change
(j) (x) AI tracking environmental changes

3. Fill in the blanks:

(a) 'Sustain'
(b) Biosphere
(c) System
(d) '+'
(e) Negative
(f) 1%
(g) Coral
(h) Environmental

4. Tick (✓) the correct option:

(a) (ii) 17
(b) (ii) 2030
(c) (i) SDG 1
(d) (iii) Biosphere
(e) (ii) Increase in X leads to increase in Y

(f) (ii) Algae expel themselves from reefs

(g) (iii) Unintended consequences

(h) (iii) Technology

(i) (ii) Climate tracking and biodiversity protection

5. Write T for true and F for false statements:

(a) T (b) T

(c) F (d) F

(e) T (f) F

(g) T (h) F

(i) T (j) T

6. Application-based Questions

(a) Water Crisis in Your City:

(i) Simple diagram showing connections:

Population Growth (+) → Water Demand (+)

Water Demand (–) → Available Water

Rainfall (+) → Available Water

Water Wastage (–) → Available Water

Available Water (–) → Water Crisis

(ii) Three ways AI could help:

1. Predictive Water Demand: AI can analyze patterns to predict when different areas will need more water based on population, weather and time of day
2. Leak Detection System: AI can monitor water pressure and flow to automatically detect broken pipes and water leaks, reducing wastage
3. Smart Distribution: AI can optimize water distribution routes and schedules to ensure fair distribution to all areas

(iii) Two SDGs this project would help achieve:

- SDG 6: Clean Water and Sanitation
- SDG 11: Sustainable Cities and Communities

(iv) Why solving water problems helps both people and the environment: Solving water problems ensures people have enough clean water for drinking, cooking and hygiene, which improves health and quality of life. For the environment, reducing water wastage means we preserve natural water sources like rivers and groundwater, maintaining ecosystems that depend on these water bodies. When we use water efficiently, we also save energy needed to pump and treat water, reducing pollution.

(b) Fishing Village and Rising Sea Levels:

(i) AI warning system design:

- Sensors: Install ocean temperature sensors, weather stations and fish tracking devices
- Data Collection: AI gathers real-time data on water temperature, storm patterns and fish migration
- Alert System: When dangerous conditions are detected (high temperatures, storms approaching), the system sends warnings to fishermen's phones
- Fish Finder: AI predicts where fish are likely to be based on temperature and ocean currents

(ii) Diagram showing connections:

Climate Change (+) → Ocean Temperature

Ocean Temperature (–) → Fish Population

Ocean Temperature (+) → Sea Level Rise

Sea Level Rise (–) → Coastal Area

Fish Population (+) → Fishing Income

Fishing Income (+) → Village Economy

Storm Frequency (+) → Fishing Safety (–)

(iii) Three solutions:

1. Alternative Livelihoods: Train villagers in sustainable aquaculture (fish farming) and eco-tourism, giving them income options when fishing is difficult
2. Sustainable Fishing Practices: Use AI to identify optimal fishing times and areas, preventing overfishing and allowing fish populations to recover
3. Coastal Protection: Build natural barriers like mangrove forests that protect the coast and provide habitat for marine life

(iv) How technology helps fishermen: Technology provides real-time weather updates so fishermen know when it's safe to go to sea. AI can predict where fish schools are located, saving fuel and time. GPS systems help them navigate safely, and emergency alert systems can call for help if needed. This makes fishing safer and more efficient.

(c) Making Your School Eco-Friendly:

(i) AI energy management plan:

- Smart Meters: Install AI-powered electricity meters that monitor usage in different parts of the school
- Temperature Control: AI adjusts heating and cooling based on occupancy, weather and time of day

- Solar/Wind Prediction: AI forecasts how much renewable energy can be generated based on weather patterns
- Energy Scheduling: AI schedules high-energy activities (like using labs) during times when solar power is abundant
- Alert System: Notifies maintenance when systems are wasting energy

(ii) Connections diagram:

Energy Use (–) → Money Saved

Energy Use (+) → Environmental Impact

Solar/Wind Energy (+) → Money Saved

Money Saved (+) → Better School Facilities

Better Facilities (+) → Student Learning

Comfortable Temperature (+) → Student Learning

Environmental Impact (–) → Student Health

(iii) Three SDGs this plan would help achieve:

- SDG 7: Affordable and Clean Energy
- SDG 13: Climate Action
- SDG 4: Quality Education

(iv) How saving energy saves money and creates better learning: When the school uses less electricity, it pays lower bills, freeing up money for books, computers and other learning resources. Clean energy reduces air pollution, making students healthier and able to concentrate better. Comfortable, well-lit classrooms with proper temperature help students focus on studies. Plus, students learn by example about environmental responsibility.

(d) Helping Farmers Grow More Food:

(i) AI solution for farmers:

- Weather Prediction: AI analyzes weather patterns to predict rainfall, droughts and extreme weather weeks in advance
- Soil Health Monitoring: Sensors and AI check soil moisture, nutrients and pH levels, telling farmers exactly what their crops need
- Crop Monitoring: Drones with cameras and AI detect plant diseases, pest infestations and growth problems early
- Irrigation Management: AI controls water supply based on soil moisture and weather forecasts, preventing water waste
- Harvest Prediction: AI estimates when crops will be ready and how much yield to expect

(ii) Simple diagram:

Climate Change (+) → Unpredictable Weather

Climate Change (+) → Extreme Temperatures

Unpredictable Weather (-) → Crop Yield

Extreme Temperatures (-) → Crop Yield

Soil Health (+) → Crop Yield

Crop Yield (+) → Food Security

Food Security (+) → Community Health

Proper Irrigation (+) → Soil Health

AI Predictions (+) → Better Farming Decisions

(iii) How this helps achieve three SDGs:

- SDG 2 (Zero Hunger): By helping farmers grow more food reliably, we ensure everyone has enough to eat
- SDG 13 (Climate Action): The system helps farmers adapt to changing climate and reduces waste of water and resources
- SDG 12 (Responsible Consumption): Precision farming means using only the water, fertilizer and pesticides actually needed, not wasting resources

(iv) Ways farmers can adapt while growing enough food:

1. Crop Diversification: Grow different types of crops that are drought-resistant or suited to new weather patterns
2. Water Conservation: Use drip irrigation and rainwater harvesting to use water efficiently
3. Timing Adjustments: Plant and harvest at optimal times based on AI weather predictions
4. Soil Protection: Use cover crops and organic methods to keep soil healthy despite changing conditions

(e) Clean Air in a Busy City:

(i) AI system design:

- Air Quality Sensors: Install sensors throughout the city that measure pollution levels in real-time
- Smart Traffic Management: AI controls traffic lights to reduce congestion and idling, and suggests less polluted routes
- Public Transport Optimization: AI predicts demand and schedules electric buses efficiently
- Pollution Source Detection: AI identifies which factories or areas are producing the most pollution
- Citizen Alerts: App notifies people when air quality is poor and suggests using public transport or working from home
- Green Transport Incentives: AI tracks and rewards people who use bikes or electric vehicles

(ii) Connections diagram:

Business Activities (+) → Jobs and Economy

Business Activities (+) → Factory Emissions

Vehicle Numbers (+) → Traffic Pollution

Factory Emissions (+) → Air Pollution

Traffic Pollution (+) → Air Pollution

Air Pollution (–) → People's Health

People's Health (+) → Work Productivity

Electric Transport (–) → Air Pollution

Green Spaces (+) → Air Quality

Economy (+) → City Development

City Development can lead to (+) Green Infrastructure

(iii) How this follows the SDG wedding cake idea: The wedding cake concept says economy must serve society within environmental limits. This plan ensures:

- Biosphere (Foundation): Clean air protects the environment and keeps it livable
- Society (Middle): People stay healthy and can enjoy good quality of life
- Economy (Top): Businesses continue operating but in cleaner ways, showing the economy serves people while respecting environmental boundaries

(iv) Three ways to grow economically while keeping air clean:

1. Green Industries: Encourage businesses that produce clean technology, electric vehicles and renewable energy, creating new jobs
2. Smart Manufacturing: Help factories upgrade to cleaner production methods with tax benefits, reducing pollution while maintaining production
3. Eco-Tourism and Services: Develop tourism and service industries that don't pollute, like technology parks, clean transport services and green spaces that attract visitors and investment