ROBOTICS & AI

Class X – Assignment Set (20 Assignments)

Instructor: **Saptarshi Jana**

Assignment 1: Introduction to Robotics

1. Who coined the term *Robot*?
2. What is the primary goal of industrial robots?

Assignment 2: Smart Technologies

1. Describe all the features of a smart classroom
2. Who is the world's first robot citizen? Explain the features of this Robot.

Assignment 3: Types of Robots

1. Name and explain the utility of the robots based on their use:
   - Space applications
   - Bio-inspired robots
   - Household robots
   - Pick-and-place robots

Assignment 4: New Age Smart Robots

1. Robots are becoming smarter day by day. Identify 3 unique new age smart robots (NARS) and write their benefits and applications.

Assignment 5: Machine vs Robot vs Cobot

1. Create a table showing differences between Machine, Robot, and Cobot.

Assignment 6: Basics of Cobots

1. What does "Co" represent in the term Cobot?
2. State all the limitations of cobots.

Assignment 7: Importance of Cobots

1. What kind of motion mimicked by collaborative robot arms?
2. Write all the importance of cobots.
3. What are the distinguishing characteristics of a cobot?

Assignment 8: Gears – Fundamentals

1. What is a gear? Explain pitch circle, pressure angle.
2. Write the principles of gears.

Assignment 9: Gear Calculations

1. If a 30-tooth driver gear rotates at 300 RPM, how many teeth does the driven gear have if it rotates at 200 RPM?
2. Gear ratio of a gear train is 3:1. How do you explain the speed transmission and toque amplification?
3. What is the gear ratio of a gear train with a 20-tooth driving gear and a 40-tooth driven gear?

Assignment 10: Python-I Strings

1. Write a Python program to input a sentence and count the total number of vowels, digits, and special characters present in it.
2. Demonstrate the use of at least five string functions — len(), upper(), lower(), startswith(), and replace() — in a single Python program using an example sentence of your choice.
3. Write a Python program to input a word and display: (a) the word reversed using slicing, (b) the first three and last three characters, (c) whether it starts with a vowel and ends with a consonant.

Assignment 11: Python-II Lists and Strings

1. **Create and Sort a List of Student Names**

   Write a Python program that performs the following tasks:

   - Create a list containing the names of **10 students** studying in your class.
   - Display the original list of student names as entered by the user.
   - Sort the list of names in **alphabetical (ascending) order**.
   - Display the sorted list of student names.

   Note: Use Python list operations and built-in sorting methods. The comparison should be case-insensitive so that names starting with uppercase or lowercase letters are sorted correctly.

2. **Count the Number of Vowels in a Given String**

   Write a Python program to count the total number of vowels present in a given string. The program should:

   - Accept a string input from the user.
   - Consider both **uppercase and lowercase** vowels (‘a‘, ‘e‘, ‘i‘, ‘o‘, ‘u‘).
   - Traverse each character of the string and check whether it is a vowel.
   - Calculate and display the **total count of vowels** present in the string.

   Note: Ignore non-alphabetic characters such as spaces, digits, and special symbols while counting vowels.

Assignment 12: Python-III Palindrome

1. **Check Whether a String is a Palindrome**

   Write a Python program that checks whether a given string is a **palindrome**. A palindrome is a word, phrase, or sentence that reads the same forwards and backwards.

   The program should perform the following tasks:

   - Accept a string input from the user.
   - Ignore all **spaces** present in the string.
   - Treat uppercase and lowercase letters as the same (case-insensitive comparison).
   - Reverse the processed string and compare it with the original processed string.
   - Display a suitable message indicating whether the given string is a palindrome or not.

   Note: Non-alphabetic characters such as punctuation marks and numbers may be ignored unless specified otherwise.

Assignment 13: 3D Design in Robotics

1. Design a 3D model of a Robot arm with 3R joints (Revolute) in Tinkercad. **Tinkercad Credentials:**
   1. https://www.tinkercad.com/joinclass/F2TLHGIR9
   2. Join with log-in code: <Yourname without any spaces>

Assignment 14: Sensors in Robotics

1. List and explain all types of sensors used in robotics with one example each.

Assignment 15: Sensor Classification

1. Differentiate between Internal and External sensors in a robot. Give examples of each type.

Assignment 16: Sensors in Applications

1. Describe how a proximity sensor and a vision sensor function in a warehouse robot to ensure safe navigation.

Assignment 17: Actuators

1. Define actuators and state their importance in robotic systems.
2. Classify actuators into linear and rotary types. Explain each with suitable examples.

Assignment 18: Pick-and-Place Operation

1. Explain how actuators work in combination with sensors to perform a pick-and-place operation in an industrial robot.

Assignment 19: Robotics Integration and Controllers

1. What is a controller in a robotic system? State its primary function.
2. Differentiate between manual and automatic control systems with examples.
3. Draw and label a block diagram showing Input - Controller - Robot - Feedback, and explain how the system maintains accuracy.
4. Explain how sensors, actuators, and controllers are interrelated in a robotic system.
5. Using an example, describe how the angular position of a robotic arm is measured and controlled.
6. Design a simple conceptual workflow showing how input data from sensors is processed by the controller to drive actuators in a mobile robot avoiding obstacles.

Assignment 20: Python

1. Write a Python program to input three numbers and find the greatest and smallest among them. **Hint:** Use conditional statements (`if`, `elif`, `else`). Don't use max(), min().

2. Write a Python program that inputs marks of five subjects, calculates the average, and displays the grade according to the following rules:

Average Marks	Grade
90 – 100	A+
80 – 89	A
70 – 79	B
60 – 69	C
50 – 59	D
Below 50	Fail

3. Write a Python program to print a pyramid pattern of stars (∗) using loops. **Hint:** Use nested `for` loops — one for rows and another for spaces and stars. **Example:**

```
If number of rows = 5, then output:
    *
   ***
  *****
 *******
*********
```

— End of Assignment Set —