ROBOTICS AND ARTIFICIAL INTELLIGENCE

Maximum Marks: 100

Time allowed: Two hours

1. *Answers to this Paper must be written on the paper provided separately.*
2. *You will **not** be allowed to write during the first **15** minutes.*
3. *This time is to be spent in reading the question paper.*
4. ***The time given at the head of this Paper is the time allowed for writing the answers.***

5. *Attempt **all** questions from **Section A** and **any four** questions from **Section B.***
6. *The intended marks for questions or parts of questions are given in brackets[ ].*

Instruction for the Supervising Examiner

Kindly read aloud the Instructions given above to all the candidates present in the Examination Hall.

This paper consists of 11 printed pages and 1 blank page.

SECTION A (40 Marks)

*(Attempt **all** questions from this Section.)*

Question 1

Choose the correct answers to the questions from the given options. [20]

(Do not copy the questions. Write the correct answers only.)

(i) Study the image given below.

In which field is this robot used?

(a) Medicine delivery

(b) Connected vehicles

(c) Smart homes

(d) Driver assisted cars

(ii) Python programming is _____.

(a) low level programming language

(b) high level programming language

(c) machine level programming language

(d) assembly level programming language

(iii) The first stage of Artificial Intelligence project cycle is _____.

(a) Modelling

(b) Problem scoping

(c) Data acquisition

(d) Evaluation

(iv) _____ are evenly spaced projections along the circumference of the gear.

(a) Pitch Circle

(b) Dedendum

(c) Teeth

(d) Hub

(v) The main function of a controller in robotics is to:

(a) keep the shape of the robot intact.

(b) change rotational directions of the Actuators.

(c) reduce friction between two gears.

(d) process sensory input and generate appropriate commands.

(vi) Why are Cobots important in industrial settings?

(a) They DO NOT work well with humans.

(b) They improve productivity by replacing human workers.

(c) They provide a safer human-robot collaboration.

(d) They do not require human control.

(vii) Identify the operation which is **NOT** allowed on a Python tuple.

(a) Accessing using an index.

(b) Converting tuple into a list.

(c) Appending a new element.

(d) Using len().

(viii) Which of the following is an example of a linear actuator in a robotic system?

(a) A motor rotating.

(b) A piston extending.

(c) A rotary joint.

(d) A gear system transmitting rotational force.

(ix) In Matplotlib, *xlabel* and *ylabel* are used to:

(a) add legend to the plot.

(b) set the axis limit.

(c) label *x*-axis and *y*-axis.

(d) colour the *x*-axis and *y*-axis.

(x) The sensor commonly used to detect obstacle in the path of a robot is:

(a) force sensor

(b) pressure sensor

(c) velocity sensor

(d) ultrasonic sensor

(xi) Software theft leads to:

(a) increase in sales

(b) financial losses

(c) increased competition

(d) promotion

(xii) _____ is an example of an external non-contact sensor used in robotics.

(a) Temperature sensor

(b) Position sensor

(c) Proximity sensor

(d) Force sensor

(xiii) The Turing test is conducted between _____.

(a) two computer programs

(b) an AI machine and a human

(c) two humans

(d) two AI machines

(xiv) Identify the steps in machine learning for teaching a machine to make decisions.

(a) Collecting data → programing

(b) Collecting data → training → testing predictions

(c) Programing for every move

(d) Programing without any data

(xv) **Assertion (A):** Autonomous systems can make decisions based on probabilistic data, whereas automated systems follow deterministic rules.

Reason (R): Autonomous systems rely on predefined rules and algorithms, while automated systems use real-time data to make decisions.

(a) Both (A) and (R) are true and (R) is the correct explanation for (A).

(b) Both (A) and (R) are true but (R) is not the correct explanation for (A).

(c) (A) is true but (R) is false.

(d) (A) is false but (R) is true.

(xvi) Who proposed the Turing test?

(a) Allen Turing

(b) Charles Babbage

(c) John won Newman

(d) Isaac Newton

(xvii) What will be the output of the code given below?

```
st="This is a test String"
v=st.count("s")
print(v)
```

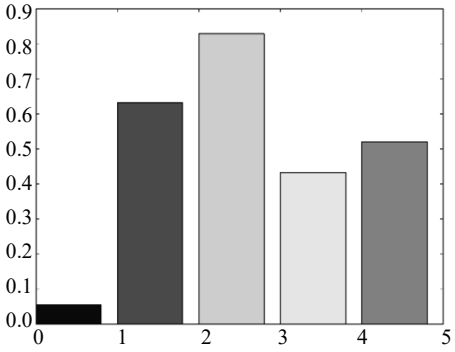
(a) 1

(b) 2

(c) 3

(d) 4

(xviii) Identify the type of graph shown below.



(a) Line graph

(b) Pie plot

(c) Bar graph

(d) Scatter plot

(xix) Which one of the following is a *single board computer*?

(a) Raspberry Pi

(b) TensorFlow

(c) PyTorch

(d) Media center

(xx) Give the output of the following Python code.

```
my_list = [1, 2, 3, 4]
my_list.append(5)
my_list.insert(2, 10)
print(my_list)
```

(a) [1, 2, 3, 4, 5, 10]

(b) [1, 10, 2, 3, 4, 5]

(c) [1, 2, 10, 3, 4, 5]

(d) [1, 2, 3, 10, 4, 5]

Question 2

Answer the following questions:

(i) What are warehouse robots and how are they used in transport industry? [2]

(ii) Read the paragraph below and answer the question that follows. [2]

"The helical gears are similar to spur gears but have angled teeth. This helical tooth arrangement enables smoother and quicker operation compared to spur gears. Helical gears are commonly used in applications where high torque transmission and reduced noise are essential."

Write *any two* key differences between *helical gears* and *spur gears*.

(iii) What are temperature sensors? [2]

(iv) What is the function of a velocity sensor in robotics? [2]

(v) Write *any two* differences between an *autonomous system* and *automated system*. [2]

(vi) Mention *any two* types of cyber threats. [2]

(vii) How does data acquisition play a key role in Artifical Intelligence project cycle? [2]

(viii) What will be the output of the following Python code? [2]

```
x = [1, 2, 3, 4]
x.append([5, 6])
print(x)
```

(ix) What will be the output of the following Python code? [2]

```
a = "hello"
b = "world"
print(a + b)
```

(x) What will be the output of the following Python code? [2]

```
x = {1: 'apple', 2: 'banana'}
x[3] = 'cherry'
print(x)
```

SECTION B (60 Marks)

*(Answer **any four** questions from this Section.)*

The answers in this section should consist of the programs in either Python environment or any program environment with Python as the base.

Each program should be written using variable description / mnemonic codes so that the logic of the program is clearly depicted.

Flowcharts and algorithms are not required.

Question 3

(i) Write *any three* benefits of *health care robots*. [3]

(ii) Give the steps involved in machine learning. [3]

(iii) Write a Python program to plot a bar chart using the *Matplotlib library*. Your program should do the following: [9]

1. Import the necessary libraries.
2. Create a list of categories and their corresponding values.
3. Plot a bar chart with appropriate labels and a title.

Question 4

(i) Describe the role of sensors in robotics. Give *any two* examples of different types of sensors. [3]

(ii) Explain how gears are used in robotics. Describe *any two* types of gears. [3]

(iii) Write a Python program to accept a string and check if the given string is a palindrome. [9]

Question 5

(i) (a) State the type of sensor which is used for each of the following purposes. [3]

1. Proximity detection
2. Vision sensing

(b) Name a type of sensor used in air conditioners.

(ii) Give *any two* differences between linear and rotary actuators. Give examples of their use in robotics. [3]

(iii) Write a Python program that performs operations on a list of integers. Your program should do the following: [9]

1. Create a list of integers: [2,4,6,9,5]
2. Check and print even numbers.
3. Check and print odd numbers.

Question 6

(i) Discuss *any two* advantages of visualising motion in a robot design. State *any one* use of Tinkercad. [3]

(ii) What are the different types of sources of data from where we can collect reliable and authentic datasets? [3]

(iii) Write a Python program to count the number of vowels in a given string. Your program should do the following: [9]

1. Define a string.
2. Traverse the string and count the vowels (a, e, i, o, u) using a loop.
3. Print the total count of vowels.

Question 7

(i) Briefly explain the **4Ws** of the Aritificial Intelligence project cycle. [3]

(ii) What is Evaluation in stages of Artificial Intelligence project cycle? [3]

(iii) Write a Python program that creates a tuple with elements from a list. Your program should do the following: [9]

1. Create a list with multiple elements.
2. Convert the list to a tuple.
3. Print the tuple and demonstrate accessing an element of the tuple.

Question 8

(i) Briefly explain *training data* and *testing data*. [3]

(ii) (a) How does the decision making by humans differ from that of the machines? [3]

(b) *Artificial Intelligence is making lives easier.* Give *any two* reasons.

(iii) Write a Python program that performs the following operations on a list of integers: [9]

1. Create a list of integers: [5, 15, 25, 35, 45].
2. Append the integer 55 to the list.
3. Insert the integer 20 at index 1.
4. Remove the integer 35 from the list.
5. Find the index of the integer 25 and print it.
6. Print the final list.