DELHI PUBLIC SCHOOL NEWTOWN

SESSION 2024-2025

FINAL EXAMINATION

CLASS: IX **FULL MARKS: 100**

SUBJECT: ROBOTICS & AI[SET-A] **TIME: 2 HOURS**

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 15 minutes.

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

Attempt all questions from Section A and any four questions from Section B. The intended marks for questions or parts of questions are given in brackets[ ]. This paper consists of seven printed pages

SECTION A

[Attempt all questions]

Question 1 Choose the correct answers to the questions from the given options. [1x20=20]
(Do not copy the question, write the correct answers only.)

(i) Select the field in which the following robot is being used:

(a) Agriculture (b) Warehouse (c) Aerospace (d) Entertainment

(ii) Which AI system is designed to **mimic** human conversation?
(a) Expert System (b) Neural Network (c) Chatbot (d) Decision Tree

(iii) Which sensor type is **primarily** used to detect motion?
(a) Light sensor (b) Proximity sensor
(c) Ultrasonic sensor (d) Motion sensor

(iv) After the pandemic, it's been essential for everyone to wear a mask. However, you see many people not wearing masks when in public

places. Which domain of AI can be used to build a system to detect people not wearing masks?
(a) Natural Language Processing (b) Computer Vision
(c) Machine Learning (d) Reinforcement Learning

(v) The primary characteristic of autonomous robots is:
(a) They require manual inputs for each task.
(b) They perform tasks without human intervention.
(c) They are limited to repetitive actions.
(d) They cannot adapt to changing environments.

(vi) In Python, variables can hold values of different types at **runtime** because:
(a) Python is dynamically typed
(b) Python is a compiled language
(c) Variables are strongly typed
(d) Data types are fixed at declaration

(vii) **Assertion (A):** AI enables machines to perceive their environment and take action.
Reason (R): Perception is not necessary for decision-making in AI.
(a) Both **A** and **R** are true, and **R** is the correct explanation of **A**
(b) Both **A** and **R** are true, but **R** is not the correct explanation of **A**
(c) **A** is true, but **R** is false
(d) **A** is false, but **R** is true

(viii) Identify the AI application from the scenario: '*A mobile app translates speech to text in real-time'.*
(a) Natural Language Processing (b) Computer Vision
(c) Reinforcement Learning (d) Robotic Automation

(ix) Which type of robot is used for exploring planets?
(a) Wheeled robots (b) Autonomous Rovers
(c) Drones (d) Legged robots

(x) Which of the following Python data structures is **immutable**?
(a) List (b) Dictionary (c) Tuple (d) Set

(xi) Bio-inspired robots are often used in which of the following scenarios?
(a) Space exploration (b) Human resources management
(c) Software testing (d) Financial data analysis

(xii) Which of the following is the second stage of AI Project life Cycle?
(a) Data Exploration (b) Data Acquisition
(c) Modelling (d) Problem Scoping

(xiii) Which of the following applications heavily relies on **probabilistic** algorithms for its functionality?
(a) Weather forecasting (b) Library management systems
(c) Spreadsheet calculations (d) Static website development

(xiv) **Assertion (A):** All robots are controlled by computer programs.
Reason (R): Computer programs allow robots to process information and perform tasks.
(a) Both **A** and **R** are true, and **R** is the correct explanation of **A**
(b) Both **A** and **R** are true, but **R** is not the correct explanation of **A**
(c) **A** is true, but **R** is false
(d) **A** is false, but **R** is true

(xv) What will be the output of the following Python expression?

```
print(10 + 3 * 2 ** 2 // 4 - 5)
```

(a) 6 (b) 7 (c) 5 (d) 4

(xvi) What will be the output of the following Python code?

```
a, b = 5, 10
result = a if a > b else b if b < 15 else a + b
print(result)
```

(a) 5 (b) 10 (c) 15 (d) 20

(xvii) What will be the output of the following Python code?

```
def func(a, b=3):
    return a * b
print(func(2))
print(func(2, 4))
```

(a) 6 and 8 (b) 6 and 12 (c) 8 and 12 (d) Error

(xviii) Which of the following is an example of a **deterministic** algorithm?
(a) Guessing the next number in a random sequence
(b) Sorting a list of integers using the quicksort algorithm
(c) Rolling a die to generate a number
(d) Generating a random password

(xix) Which of the following correctly defines the **"Degree of Freedom"** (DOF) in a robotic system?
(a) The total number of movements a robot can make
(b) The number of independent axes a robot can move along
(c) The number of sensors a robot uses
(d) The number of motors installed in a robot

(xx) Which type of robot is best suited for inspecting **underwater** pipelines?
(a) Drones (b) AUVs (c) Exoskeletons (d) Humanoids

Question 2

(i) *Autonomous drones are widely used for aerial surveillance and delivery systems*. Name any **two** industries where drones have significantly impacted operations. [2]

(ii) Define and differentiate between translational and rotational motion in the context of robotic movement. [2]

(iii) *AI-driven chatbots are increasingly used in businesses for customer service and support*. Mention two advantages of using chatbots in industries. [2]

(iv) Mention any **one** area where a prismatic joint is useful in robotic systems. [2]

(v) State **one** difference between artificial intelligence and machine learning. [2]

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

```
x, y, z = 2, 4, 6
z, x, y = x + z, y - z, x * y
x, y, z = z % y, x // z, y + x
print(x, y, z)
```

(vii) Predict the output of the following: [2]

```
def switch_case(value):
    match value:
        case 1:
            return "One"
        case 2:
            return "Two"
        case 3:
            return "Three"
        case _:
            return "Default"
x = 2
y = 4
print(switch_case(x + y - 3))
```

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

```
import math
x = -25.67
y = 16
result1 = math.fabs(x) + math.sqrt(y)
result2 = math.floor(result1)
print(result1)
print(result2)
```

(ix) Write the output of the following code: [2]

```
z = ["AI", ("Machine Learning", "Deep Learning"), {"Python",
"Java"}, {"lang": "C++", "version": 11}]
print(z[1])
print(type(z[2]))
print(z[3]["lang"])
```

(x) Aman executes the following program. [2]

```
for i in range(5, 2):
    print(i)
```

He doesn't get the desired output. His desired output is:
5
4
3
What error did he make and what correction should be made to get the desired output?

SECTION B
(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) Suhana works for a company wherein she was assigned the task of developing a project cycle. Help her to identify the **stages** of **AI Project Life Cycle.** [3]

(ii) A home-assistant robot is tasked with watching over a young child playing in the garden. The robot is programmed with **Asimov's Three Laws of Robotics.** [2]
The child notices the robot moving toward a charging station and commands it to stay and play. However, the robot detects that its battery level is critically low, and if it does not charge, it might stop functioning. This could leave the child unsupervised, potentially putting them in danger.

Which law should the robot **prioritize** in this situation and **why**?

(iii) A local bookstore is offering discounts on purchases based on the following criteria: [10]

Total Purchase Amount	Discount
Up to ₹500/-	5%
₹501 to ₹1,500/-	10%
Above ₹1,500/-	20%

Write a Python program to accept the total purchase **amount (A)** from the user, calculate the **discount (D)** based on the criteria and display the total discount amount and the final payable **amount (AD).**

Question 4

(i) What are the main differences between Deterministic decision making by humans and Probabilistic decision making by machines? [2]

(ii) How do robots help in improving warehouse operations? Provide **two** specific examples. [3]

(iii) Write a Python program to print the following pattern based on the number of **rows (N)** entered by the user: [10]
For N = 5, the output should be:
1
2 3
4 5 6
7 8 9 10
11 12 13 14 15

Question 5

(i) Give **one** difference between angular and circular motion. Mention the types of joints used in each motion. [2]

(ii) As AI systems become more integrated into industries like healthcare, finance, and transportation, they also become prime targets for cyberattacks. Traditional methods for securing AI systems are insufficient because they often fail to account for sophisticated attacks like adversarial inputs, data poisoning, and model theft. These vulnerabilities pose significant risks, including incorrect predictions, financial losses, and compromised sensitive data. [3]
(a) **Who** faces this challenge?
(b) **What** is the nature of the challenge?
(c) **Where** do such vulnerabilities occur?

(iii) A **neon number** is a number where the sum of the digits of its square equals the number itself. [10]
For example: 9 is a neon number because 9^2=81 and 8+1=9.
Write a Python program that includes a **user-defined function *neon(num)*** to accept a number as input from the user and check if the number is a neon number. It should return ***True*** if it is a neon number, otherwise return ***False***.

Question 6

(i) *A hospital uses an AI system to analyze X-rays and MRI scans, accurately diagnosing diseases like pneumonia but unable to perform tasks beyond its training. Meanwhile, researchers aim to develop a general-purpose AI that can diagnose, treat, and learn across medical domains.* [3]
Differentiate between the AI system used in the hospital and the one being developed by researchers. Explain which category of AI each system belongs to and **justify** your answer.

(ii) Explain the term '**coordinated joint movement'**. [2]

(iii) Write a Python program using user defined function that accepts an integer and increments the value by **5**. Also display the id of argument (**before function call**), id of parameter **before increment** and **after increment.** [10]

Question 7

(i) What must you keep in mind while collecting data in **Data acquisition** stage of AI Project Framework so that it is useful? [3]

(ii) Give any **two** differences in the design features of an underwater robot and an aerial robot. [2]

(iii) Write a program that simulates a traffic light. The program should consist of the following: [10]
A user defined function **trafficLight( )** that accepts input from the user, displays an error message if the user enters anything other than RED, YELLOW, and GREEN. Function **light()** is called and following is displayed depending upon return value from light().
a) "*STOP, your life is precious*" if the value returned by light() is 0.
b) "*Please WAIT, till light is Green*" if the value returned by light() is 1
c) "*GO! Thank you for being patient*" if the value returned by light() is 2.

Question 8

(i) Explain **NAND** gate with its logic gate diagram, truth table and corresponding expression. [3]

(ii) Write **any two** applications of robots in agriculture. [2]

(iii) Write a Python program to find the sum of **1+ 1/8 +1/27.....1/n^3**, where **n** is the number input by the user. [10]