ISC

YEAR 2027

INDIAN SCHOOL CERTIFICATE EXAMINATION

COUNCIL FOR THE INDIAN SCHOOL CERTIFICATE EXAMINATIONS
CISCE
NEW DELHI
Empowering Minds & Transforming Lives since 1958

ROBOTICS (884)

February 2025

Council for the Indian School Certificate Examinations (CISCE)

MISSION STATEMENT

The Council for the Indian School Certificate Examinations is committed to serving the nation's children, through high quality educational endeavours, empowering them to contribute towards a humane, just and pluralistic society, promoting introspective living, by creating exciting learning opportunities, with a commitment to excellence.

ETHOS OF CISCE

- Trust and fair play.
- Minimum monitoring.
- Allowing schools to evolve their own niche.
- Catering to the needs of the children.
- Giving freedom to experiment with new ideas and practices.
- Diversity and plurality - the basic strength for evolution of ideas.
- Schools to motivate pupils towards the cultivation of:

  Excellence - The Indian and Global experience.

  Values - Spiritual and cultural - to be the bedrock of the educational experience.
- Schools to have an 'Indian Ethos', strong roots in the national psyche and be sensitive to national aspirations.

ROBOTICS (884)

This subject may be taken with Computer Science but not with Artificial Intelligence.

Aims

1. To develop an understanding of concepts and applications of Robotics.
2. To develop competencies in Robotics via., classroom instruction, laboratory and self-directed project-based learning approach.
3. To facilitate appreciation, understanding and application with introductory concepts of Robotics and Mechanical, Electrical and Computing Sub Systems.
4. To introduce programming concepts used in Robotics.
5. To familiarize students with the integration of subsystems.
6. To facilitate appreciation, understanding and application of Robotics.
7. To discuss Types of Robots based on applications.
8. To provide examples of application-based robots.

CLASS XI

There will be two papers in the subject:

***Paper I**: Theory - 3 hours ... 70 marks*

***Paper II**: Practical - 3 hours ... 15 marks*

Project Work ... 10 marks

Practical File ... 5 marks

PAPER I- THEORY: 70 Marks

S. NO.	UNIT	TOTAL WEIGHTAGE
1.	**Introduction to Robotics**	**10 Marks**
2.	**Mechanical System**	**15 Marks**
3.	**Computing Systems**	**20 Marks**
4.	**Electrical and Control Systems**	**15 Marks**
5.	**Applications of Robotic Systems**	**10 Marks**
TOTAL		**70 Marks**

PAPER I - THEORY- 70 Marks

1. Introduction to Robotics

(i) What is a robot?

Understanding what robots are and how they operate autonomously or semi-autonomously using sensors and AI.

(ii) New Age Robotics Systems.

Advanced AI and machine learning applications in smart manufacturing, healthcare, and autonomous vehicles.

(iii) Components of Robots.

System Visualization, Design, and Creation, Utilizing CAD modeling and precision manufacturing to create sensors, actuators, and control units.

(iv) Relating Physics & Mathematics to Robotics.

Applying principles for motion, forces, control, algorithms for programming, and problem-solving.
Matrix Operations: Essential for transformations, handling coordinate systems, and calculating rotations and translations in robotic arms.
Vectors and Vector Spaces: Used for calculating direction, force, and position in space, especially in multi-dimensional tasks.

(v) Project Management.

Planning, execution, and monitoring, Ensuring robotic projects meet goals, are completed on time, within budget, and adhere to quality standards.

2. Mechanical System

(i) Frames and Reference Frames.

Frames: In robotics and mechanical systems, representation of a coordinate system defining the position and orientation of objects within that system, provide a reference for defining the movement and positioning of robotic components.
Reference Frames: Understanding moving and fixed frames, crucial for robot movement and positioning.
Fixed Frames: These are stationary frames that serve as a stable reference point. For instance, in a robotic arm, the base frame of the robot is often fixed to the ground, providing a constant reference for the entire system.
Moving Frames: These frames move along with the object they are attached to, allowing for dynamic reference points. For example, each segment of a robotic arm may have its own moving frame, which changes position as the arm moves.

(ii) Degrees of Freedom.

3D Modelling, designing structures by manipulating shapes in a virtual space, with the option to move, scale, and rotate them along all three axes. TinkerCAD as a beginner-friendly, browser-based tool for creating 3D models. Design of different structures using Tinker Cad.

(iii) Planar Mechanisms.

Planar mechanisms operate in a two-dimensional plane, typically with motion restricted to a single plane with real life examples.

(iv) Spatial Mechanism.

Three-dimensional mechanisms, operate in three-dimensional space and allow motion in multiple directions with real life examples(Qualitative with pictures).

(v) Robot Kinematics.

Planar open chain mechanism, Forward kinematics of different planar configurations, such as 2R and RP, allows to compute the position based on the joint variables or displacements.

(vi) Different Components of Robot.

Examining frames, materials (MDF,acrylic, aluminum, steel), and wheel types (standard, castor, Mecanum, Omni).

(vii) Coordinate Systems.

Cartesian, polar, and cylindrical coordinates used for robot positioning and movement.

(viii) Specification of Robots.

Resolution: Reference to the smallest incremental movement that a robot can detect or achieve, robot's control system and sensors.

Current Trends: Higher Resolution Encoders particularly in applications requiring high precision, such as electronics or biomedical manufacturing.

Sub-Micron Resolution: High-precision applications, robots, sub-micron levels and semiconductor manufacturing.

Integrated Vision Systems: Integrated vision systems that enhance resolution by allowing real-time adjustments based on visual feedback.

Accuracy: Ability to position its end-effectors precisely at a desired location.

Current Trends: Enhanced Calibration Techniques- Achieve better absolute accuracy. Calibration accounts for all joints and links, minimizing errors in each part of the robot arm.

Dynamic Error Compensation: Dynamically adjust for temperature changes, wear, and other environmental factors to maintain accuracy.

Feedback Mechanisms: Laser-based tracking and real-time correction.

Repeatability: Ability to return to a specific position under identical conditions repeatedly.

Current Trends: Sub-Millimeter Repeatability: Tasks requiring high consistency, such as spot welding in automotive production.

Improved Mechanical Design: Improved repeatability, as the mechanical components and more reliable over repeated cycles.

Adaptive Control Systems: Adaptive control systems, complex, repetitive motions, such as pick-and-place operations in logistics or packaging.

3. Computing Systems

(i) Boolean operators (AND, OR, NOT). *Application in robotics for decision-making.*

(ii) Microcontroller / SBC Architecture.

Understanding block diagrams and architecture.

(iii) Programming Fundamentals.

Algorithms, flowcharts, pseudo code, microcontroller/SBC programming, basic embedded C programming, interrupts, and timers.

(iv) Debugging and Testing.

Ensuring correct and efficient program execution.

4. Electrical and Control Systems

(i) Motors and Sensors.

Types of motors (DC, Servo) description, characteristics, application, advantages and disadvantages.
Sensors (IR, ultrasonic, LIDAR, touch, gyroscopes, accelerometer) description, working principle, application, advantages and disadvantages.

(ii) Batteries.

Types of batteries commonly used in robotics (lithium-ion,lead-acid),characteristics, applications and drawbacks.

(iii) Communication protocol.

UART, I2C, SPI, CAN.

Comparison and key characteristics, differences, uses, speed and performance, error detection and reliability.

(iv) Power Requirement.

Power requirements of different robotic components depending on type, size and functionality, such as motors, sensors, actuators, and microcontrollers.

(v) Control Systems.

Basics of control systems ensuring accurate, efficient, and safe robot performance.

5. Applications of Robotic Systems

(i) Manipulators

Study the basic mathematical concepts and control strategies used in analyzing robotic manipulator arms, emphasizing their practical use in automating industrial processes and assembly tasks.

(ii) Mobile Robots

Examine the basic design principles and sensor integration techniques for autonomous mobile robots, emphasizing their role in logistics, transportation, and search and rescue operations.

(iii) Drones

Applying the principles of aerial robotics and drone technology, including sensor payloads, and regulations, with applications in aerial photography, agriculture, and disaster response.

PAPER II – PRACTICALS-30 Marks

The practical paper of three hours duration will be evaluated internally by the school. The paper shall consist of three problem statements from which a candidate has to attempt any ***one*** problem statement.

The practical consists of two parts:

(1) Planning/ Writing Session
(2) Examination Session

The total time to be spent on the Planning/Writing Session and the Examination session is three hours. A maximum of 90 minutes is permitted for the Planning/Writing Session and 90 minutes for the Examination session. **Candidates are to be permitted to proceed to the Examination Session <u>only after</u> the 90 minutes of the Planning / Writing Session are over.**

Planning/Writing Session

The candidates will be required to prepare an algorithm and a handwritten program to solve the problem.

Examination Session

The program handed in at the end of the Planning/Writing session shall be returned to the candidates. The candidates will be required to do and execute the program, circuit on seen and unseen inputs individually on the computer, hardware and show execution to the examiner. A printout of the program listing, including output should be attached to the answer script containing the handwritten program and hardware results. This should be returned to the examiner. The program should be sufficiently documented so that the apparatus/components required, circuit diagram/block diagram, algorithm/flowchart, representation, development process, observations/output is clear from reading the program. Large differences between the planned program and the printout will result in loss of marks.

Teachers should maintain a record of all the assignments done as part of the practical work throughout the year and give it due credit at the time of cumulative evaluation at the end of the year. Students are expected to do a **minimum** of twenty assignments for the year and **ONE** project based on the syllabus.

<u>LIST OF SUGGESTED ASSIGNMENTS/EXPERIMENTS:</u>

Some sample problems are given below as examples. The problems are of varying levels of difficulty:

1. Provide physical objects and demonstrate how to describe their positions using Cartesian, polar, and cylindrical coordinate systems.
2. Construct a simple robotic arm and analyze its degrees of freedom and range of motion.
3. Connect sensors such as ultrasonic, infrared, or camera sensors to a robot and perform tasks like obstacle avoidance or object detection.
4. Use a microcontroller (e.g., Arduino) to program basic robot movements such as forward, backward, left, and right.
5. Use inverse kinematics to control the end-effector of a robotic arm to reach specific target positions.
6. Program a robot to detect obstacles using sensors and navigate around them autonomously.

7. Use Bluetooth or Wi-Fi modules to establish wireless communication between a robot and a remote-control device.
8. Use simulation software to model and simulate robotic systems performing various tasks.
9. Choose a robotics project (e.g., autonomous robot navigation, robotic arm manipulation) and work in teams to design, build, and demonstrate their project.

NOTE: This list is indicative only. Teachers and students should use their imagination to create innovative and original assignments.

EVALUATION OF ASSIGNMENTS

Marks (out of 30) should be distributed as given below.

Continuous Evaluation

Candidates will be required to submit a work file containing the practical work related to assignments done during the year and **ONE** project.

Assignments done throughout the year	10 marks
Project Work (based on any topic from the syllabus)	5 marks

Proposed Guidelines for Marking

The actual grading will be done by the teacher based on his/her judgment. One possible way: divide the outcome for each criterion into one of 3 groups: excellent, good, poor/unacceptable, then use numeric values for each grade and add to get the total.

Evaluation will be done as follows:

Assignments: 10 Marks

Criteria (Total 10 marks)	Class design - Execution (4 marks)	Documentation Practical File (6 marks)
Excellent	4	6
Good	3	4
Poor	1	2

Project Work: 5 marks

Criteria (Total 5 marks)	Knowledge and Understanding (1 marks)	Functionality and Performance (3 marks)	Presentation (1 marks)
Excellent	1	3	1
Good	1	2	1
Poor	1	1	1

Terminal Evaluation

Solution to Problem Statement on Hands-On/ Programming	15 marks

Marks should be given for choice of algorithm and implementation strategy, circuit making, documentation, correct output on known inputs mentioned in the question paper, correct output for unknown inputs available only to the examiner.

CLASS XII

There will be two papers in the subject:

***Paper I**: Theory - 3 hours ... 70 marks*

***Paper II**: Practical - 3 hours ... 15 marks*

Practical File ... 15 marks

PAPER I- THEORY: 70 Marks

S. NO.	UNIT	TOTAL WEIGHTAGE
1.	**Introduction**	**12 Marks**
2.	**Robotics in Healthcare**	**16 Marks**
3.	**Robotics in Agriculture**	**16 Marks**
4.	**Smart Manufacturing and Industry 4.0/5.0**	**16 Marks**
5.	**Space Robotics**	**10 Marks**
TOTAL		**70 Marks**

PAPER I – THEORY – 70 Marks

Note: Key concepts of Class XI need to be revised as a prerequisite

1. **Introduction**

(i) Design and Selection Parameter of a Robot.

Fundamental principles and considerations in designing and selecting robots for various applications.

(ii) Basic introduction to ROS and Gazebo.

Robot Operating System (ROS) and the Gazebo simulation environment, essential tools for robot development and simulation.

(iii) Robotics Ethics.

Accountability, Privacy and Surveillance, Human-Robot Interaction, Impact on Employment, Safety and Security, Autonomy vs. Control, Social Implications, Military and Defense, Environmental Impact.

2. **Robotics in Healthcare**

(i) Introduction

Represents a transformative shift in medical procedures, patient care, rehabilitation, and technological advancements, with applications in complex surgeries, patient assistance, diagnostics, and physical therapy.

(ii) Types of Robots

Surgical Robots, Assistance Robots, Diagnostic Robots, Rehabilitation and Therapy Robots.

(iii) Application

a. da Vinci Surgical System

Working Principle: operates on the principle of minimally invasive robotic-assisted surgery and controlled by a surgeon from a console, the system translates hand movements into precise micro-movements of tiny instruments inside the patient's body through a high-definition, 3D magnified view, which provides paralleled accuracy and precision, minimizing tissue trauma and reducing recovery time.
Components: Surgeon Console, Patient Cart, Vision System, Endo wrist Instruments
Advantages: Enhanced Precision, Minimally Invasive, High-Definition Visualization, Reduced Fatigue for Surgeons

b. Ultrasound Robotic System

Working Principle: diagnostic imaging by automating the positioning and movement of the ultrasound probe. Controlled remotely or semi-autonomously, follows pre- programmed instructions which ensures consistent and accurate imaging, reducing variability and improving diagnostic quality.
Components: Robotic Arm, Control System, Ultrasound Probe, Display and Image Processing Unit.
Advantages: Consistent Imaging Quality, Enhanced Precision in Diagnosis, Reduced Technician Strain.

c. Exoskeleton Robots

Working Principle: mimicking and supporting natural body movements, wearable devices that provide powered support to the user's limbs, enabling movement and reducing strain. Sensors detect the movements or intentions, allowing the exoskeleton to respond accordingly. Assist patients with mobility impairments in regaining strength and motor function.
Components: Structural Frame, Motors and Actuators, Control System, Sensors
Advantages: Improved Mobility, Rehabilitation Support, Enhanced Strength and Endurance.

3. **Robotics in Agriculture**

(i) Introduction

Application of robotics and artificial intelligence (AI) in farming, improve productivity, reduce costs, and support sustainable practices. Agricultural robots, or "agrobots," for planting seeds and spraying pesticides to monitoring crop health and harvesting.

(ii) Types of Robots

Seeding and Spraying Robot, Ground Mobile Robot (Weeding Robot, Harvesting Robot, Pruning Robot),Monitoring and Sensing Robot.

(iii) Application

a. Seeding and Spraying Robot

Working Principle: *based on GPS and sensor data to ensure precise placement and application, navigate fields using predefined coordinates, placing seeds at specified intervals or spraying crops with the right amount of chemicals.*

Components: *GPS Module, Sensors, Spraying System, Seeding Mechanism, Power Source.*

Advantages: *Precision Farming, Labour Reduction, Environmental Benefits.*

b. Ground Mobile Robot

Working Principle: *move autonomously across the farm, scanning and collecting data on soil conditions, crop health, and more. Operate using wheels or tracks, equipped with GPS for navigation.* Components of the System: *Mobility System.Control Unit, GPS Module, Imaging and Sensing Equipment, Communication Module*

Advantages of the System: *Efficient Field Coverage, Real-Time Data Collection, Saves Resources.*

c. Monitoring and Sensing Robot

Working Principle: *Monitoring and sensing using cameras and sensors to assess crop health, detect pest infestations, and monitor soil moisture levels.*

Components of the System: *Imaging Sensors, Environmental Sensors, Data Storage and Processing Unit, Communication System, Power Source.*

Advantages of the System: *Data-Driven Insights, Early Problem Detection, Improves Yield Quality.*

4. Smart Manufacturing and Industry 4.0/5.0.

(i) Introduction

Integrates digital technology and automation to enhance manufacturing efficiency, flexibility, and intelligence. Emphasizes the connectivity of machines, data, and artificial intelligence to create smart factories, brings in human-centric approaches.

(ii) Types of Robots

Industrial Robot Arms, Collaborative Robots (Cobots), Automated Guided Vehicles (AGVs), 3D Printing Robots, Robotic Welding Systems.

(iii) Application

a. Manipulator

Working Principle: Arms with multiple joints that simulate human arm movements to manipulate tools or work pieces, uses servo motors and controllers, the manipulator follows programmed paths, allowing precise positioning and controlled force application.

Components: *Actuators, Controller, End-Effector, Sensors, Power Supply.*

Advantages: *Precision, Speed, Reduced Labor Costs.*

b. Security and Sensing Robot

Working Principle: *Patrol factory floors, using sensors and cameras to monitor environments for safety and security. Operates autonomously, analyzing surroundings in real-time and alerting personnel to issues like unauthorized access, fire hazards, or machinery malfunctions. Equipped with AI, they can process data to detect anomalies and potential threats.*

Components: *Sensors, Navigation System, AI Processor, Communication Module, Power Source.*

Advantages: *Enhanced Security, Incident Detection, Data Collection*

c. Collaborative Robots (Cobots)

Working Principle: *Uses sensors to detect human presence, and algorithms to ensure safe interactions, handle tasks that require precision and* *flexibility, assisting humans with labor-intensive activities*

Components: *Sensors, AI-Driven Control Unit, End-Effector, Feedback Systems, Power Supply.*

Advantages: *Safety, Adaptability, Enhanced Productivity.*

5. **Space Robotics**

(i) Introduction

Exploring and understanding the vast expanse beyond Earth as essential in exploring planets, moons, and asteroids. Carryout tasks that would be dangerous or impossible for humans, such as collecting samples, studying environments, and assisting in construction and repair tasks in space.

(iii) Types of Robots

Planetary Rovers, Space Probes and Landers, Space Station robotics.

(iii) Application

a. Mars Rover Program

Working Principle: *Operate semi-autonomously, relying on instructions sent from Earth, use of sensors, cameras, and AI algorithms to navigate Martian terrain, avoid obstacles, and perform tasks such as drilling and soil analysis.*

Components: *Power Source, Mobility System, Camera and Imaging Systems, Scientific Instruments, Communication System.*

Advantages: *Remote Exploration, Data Collection, Autonomous Operation.*

b. Chandrayaan-2 Mission

Working Principle: *studying the Moon's surface and its mineral composition. performs remote sensing, operate semi-autonomously, gathering data and transmitting it back to Earth.*

Components: *Orbiter, Lander (Vikram), Rover (Pragyan), Power Source, Communication System.*

Advantages: *Detailed Lunar Study, National Achievement, Cost-Effective Research.*

c. Gaganyaan–Vyommitra

Working Principle: *Vyommitra, the humanoid robot developed for ISRO's Gaganyaan mission, functions similarly to advanced robotic systems like the Canadarm2. It operates by responding to commands from mission control and astronauts aboard the spacecraft.*

Components: *Joints and Actuators, End Effectors, Sensors and Cameras, Power Source.*

Advantages: *Versatility, Precision, Enhanced Safety.*

PAPER II – PRACTICALS -30 Marks

The practical paper of three hours' duration will be evaluated by the Visiting Examiner appointed locally and approved by CISCE.

The paper shall consist of three problem statements /problems from which a candidate has to attempt any one. The practical consists of two parts:

(1) Planning/ Writing Session
(2) Examination Session

The total time to be spent on the Planning/Writing Session and the Examination session is three hours. A maximum of 90 minutes is permitted for the Planning/Writing Session and 90 minutes for the Examination session.

Candidates are to be permitted to proceed to the Examination Session <u>only after</u> the 90 minutes of the Planning / Writing Session are over.

Planning/Writing Session

The candidates will be required to prepare an algorithm and a handwritten program to solve the problem.

Examination Session

The program handed in at the end of the Planning/Writing session shall be returned to the candidates. The candidates will be required to do and execute the program individually on the computer, hardware and show execution to the Visiting Examiner. A printout of the program listing including output results should be attached to the answer script containing the handwritten program and hardware results. This should be returned to the examiner. The program should be sufficiently documented so that the apparatus/components required, circuit diagram/block diagram, algorithm/flowchart, representation, development process, observations/output is clear from reading the program. Large differences between the planned program and the printout will result in loss of marks. Teachers should maintain a record of all the assignments done as part of the practical work throughout the year and give it due credit at the time of cumulative evaluation at the end of the year. Students are expected to do a **minimum of twenty-five assignments** for the year.

The details are as follows:

Details of Assignments to be done during the year

Broad Area	Number of Assignments
Practical (Programming)	15
Hands-on (Case Study)	10
TOTAL	**25**

LIST OF SUGGESTED ASSIGNMENTS:

Some sample problems are given below as examples. The problems are of varying levels of difficulty:

1. Design and build a simple robot using basic materials like cardboard, motors, and sensors.
2. Explore Robot Operating System (ROS) and simulate a robotic system using Gazebo simulation environment.
3. Research and present a case study on the application of robotics in healthcare, focusing on surgical robots, rehabilitation robots, or telepresence robots.
4. Design a robot tailored for agricultural applications, considering factors like mobility, sensing, and autonomy.
5. Develop an implementation plan for integrating robotics and automation in a manufacturing facility as part of Industry 4.0 initiatives.
6. Propose a robotic mission for space exploration, outlining the mission architecture, payload requirements, and scientific goals.
7. Create educational robotics kits or tutorials for teaching robotics concepts to younger students or beginners.
8. Participate in a debate or discussion on ethical considerations in robotics, exploring topics like autonomy, privacy, and safety.
9. Design and build a robot to compete in specific challenges, such as maze navigation, object manipulation, or obstacle avoidance.
10. Pursue a self-directed robotics innovation project, exploring emerging technologies, novel applications, or interdisciplinary collaborations.

NOTE: This list is indicative only. Teachers and students should use their imagination to create innovative and original assignments.

EVALUATION OF ASSIGNMENTS

Marks (out of 30) should be distributed as given below.

<u>Continuous Evaluation</u>

Candidates will be required to submit a work file containing the practical work related to assignments done during the year.

Assignments done throughout the year (Internal Evaluation)	10 marks
Assignments done throughout the year (Visiting Examiner)	5 marks

Proposed Guidelines for Marking

The actual grading will be done by the teacher based on his/her judgment. One possible way: divide the outcome for each criterion into one of 3 groups: excellent, good, poor/unacceptable, then use numeric values for each grade and add to get the total.

Evaluation will be done as follows:

Assignments: **10 Marks**

Criteria (Total 10 marks)	Class design - Execution (4 marks)	Documentation Practical File (6 marks)
Excellent	4	6
Good	3	4
Poor	1	2

Terminal Evaluation

Solution to Problem Statement on Hands-On/ Programming	15 marks

Marks should be given for choice of algorithm / flowchart / circuit / block diagram, and implementation strategy, circuit making, documentation, correct output on known inputs mentioned in the question paper, correct output for unknown inputs available only to the examiner.

Note: Program logic should be expressed through algorithm or flowchart; circuit or block diagram, and listing required apparatus or components and writing observations/output.

LABORATORY REQUIREMENTS

(For a class of 30 students)

Sl. No.	Name of Components	Quantity
1	Joystick	15
2	Accelerometer and Gyro Sensor	10
3	IR Sensor	15
4	Ultrasonic Sensor	15
5	PIR Motion Sensor	15
6	Temp. Sensor	15
7	Soil Moisture Sensor	15
8	Gas detector Sensor	15
9	Trimmer Potentiometer	15
10	Mini micro submersible water pump	5
11	Wheel 65mm	4
12	BO Wheel 70mm	4
13	Water flow measurement sensor	1
14	LED Matrix4 in 1 display	5
15	Switch keyboard	5
16	Bluetooth Module with button	10
17	BO Motor straight	15
18	Motor driver module (L298N)	10

Sl. No.	Name of Components	Quantity
19	Servo motor	15
20	Stepper Motor (D Type shaft)	5
21	Breadboard 400 Pin	10
22	Lithium Polymer battery (2200mAh)	3
23	Buzzer (pack of 5 Nos)	2
24	Transistor	1
25	Linear Voltage Regulator (Pack of three)	5
26	Capacitor Assorted Kit	1
27	LED Assortment Kit	1
28	Metal Film Resistor	2
29	Digital Multimeter	2
30	Tactile Push Button Switch 6x6x5 (Pack of 10)	2
31	Soldering Iron with Solder Wire	2
32	Wire stripper and cutter	5
33	Mecanum Wheels (80MM)	4
34	LCD Display	10
35	Dupont Cable (40 pin)	10
36	Jumper wires (M& F ,F &F M&M)	20 each
37	Stepper motor driver	10
38	Hook up Wire Kit	2
39	Lithium Polymer Battery (1000mAh)	30

Sl. No.	Name of Components	Quantity
40	SPST Rocker Switch	10
41	Digital LDR Module	15
42	Arduino UNO with cable	45
43	Battery holder	10
44	Battery with connector	15
45	Raspberry Pi 5, 8 GB / ESP32	5
46	Measuring Tape 5M	1
47	Screw Driver set	1
48	Parallel Charging Board (pack of 6)	1
49	Multipurpose PCB Ruler	1
50	Omni Wheel (90 mm)	4
51	NodeMcu (ESP8266 V3 Lua CH340 Wifi Dev. Board)	10
52	LDR 5mm (Pack of 10)	2
53	Dust Smoke particle Sensor (PM2.5)	1
54	Light Assorted Kit	2
55	Proto Screw Shield	5
56	Computer Desktop System Configuration: (Dell Optiplex 3000 Desktop 12th Generation Intel Core I5-12500 Processor Intel B660 Chipset 2GB NVidai Dedicated Graphics ENERGY STAR Qualified 8GB, DDR4, Non-ECC Ram 3200 Mhz M.2 512GB Gen 4 PCIe NVMe Solid State Drive Power Cord 1M for India Dell USB Keyboard & Optical Mouse Windows 11 Pro OEM with License Dell 24” Display Wifu Card + HDMI 1 Mtr. Cable 3 Years onsite Warranty Micro-Tech UPS - 600 VA (15 mins)	10

SAMPLE TABLE FOR PRACTICAL WORK

S. No.	Unique Identification Number (Unique ID) of the candidate	Assessment of Practical File		Assessment of the Practical Examination (To be evaluated by the Visiting Examiner only)				TOTAL MARKS (Total Marks are to be added and entered by the Visiting Examiner)
		Internal Evaluation 10 Marks	Visiting Examiner 5 Marks	Algorithm	C/Python Program with internal Documentation	Hard Copy (printout)	Output	
				3 Marks	7 Marks	2 Marks	3 Marks	30 Marks
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

Name of the Visiting Examiner:___________________________________

Signature: _________________________________

Date:_____________________________________