# Module 1: Foundations of Robotics & Microcontrollers

## 20-Class Detailed Syllabus • Robotics Education Platform

Target Audience: Absolute Beginners / School Students (Ages 10–15)
Total Duration: 20 Classes (1 Hour Each)

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| Class # | Topic & Components | What You Will Build & Learn |
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| **Class 1** | **Robotics Safety & Circuit Basics**Voltage, Current, & Resistance; Breadboards & Multimeters | Learn basic electrical safety, build your first LED circuits, and use a multimeter to measure voltage and test your wiring. |
| **Class 2** | **Meet the Microcontroller & Coding Setup**Arduino Uno, Nano, & Mega; Arduino IDE Setup | Set up your coding software, connect your computer to the Arduino, and run your first hardware communication check. |
| **Class 3** | **Light Up Your World: Digital Outputs**LEDs, RGB Light Modules, & LED Bars; Timing & Light Signals | Code custom blinking light patterns, create strobe effects, and mix vibrant colors using multi-color RGB LEDs. |
| **Class 4** | **Buttons & Switches: Digital Inputs**Push Buttons, Keypad Matrix, & Toggle Switches; Logic & Pull-Up Resistors | Read button presses, program 4×4 matrix keypads, and make your code react instantly when a user enters inputs or presses buttons. |
| **Class 5** | **Knobs & Analog Control: Joysticks**Potentiometers, Light-Sensors (LDR), & 2-Axis Joysticks; Reading Real-World Signals | Connect continuous knobs, LDRs, and dual-axis analog joysticks to measure changing signals and display real-time sensor data on your screen. |

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| **Class 6** | **Dimming Lights & Smooth Speed Control**Pulse Width Modulation (PWM); Fading Effects & Signal Control | Master power control to create smooth LED "breathing" and dimming effects, and control light brightness smoothly. |
| **Class 7** | **Hardware Workshop: Soldering & Header Pin Assembly 101**Soldering Irons, Flux, & Safety; Joining Wires, Tinning, & Soldering Sensor Header Pins | Get hands-on with real engineering tools! Learn how to safely melt solder, connect wires permanently, and solder pin headers onto custom sensor modules. |
| **Class 8** | **Permanent Circuit Fabrication on Veroboard**Stripboard/Veroboard Prototyping; Cutting Circuit Tracks, Component Assembly, & Continuity Audits | Move your projects off temporary breadboards! Solder components onto permanent veroboards, cut copper tracks cleanly, and test them for zero short circuits. |
| **Class 9** | **Environmental & Hazardous Gas Sensing**Gas Sensors (MQ-2 / MQ-135 Smoke & Gas), Temp/Humidity (DHT11), LDR; Sensor Calibration & Threshold Alerts | Interface gas/smoke sensors alongside temperature and humidity modules. Program hazardous gas threshold alarms and environmental indicators. |
| **Class 10** | **Project 1: Smart Automatic Street Light & Safety Relay**Light Sensor + 5V Relay + High-Power Light; Controlling High Voltage Safely | **Hands-On Build:** Build a smart streetlight system that automatically turns on a bright light when the room gets dark. |
| **Class 11** | **Sound, Wireless IR Remotes, & Audio Alerts**Active/Passive Buzzers & Handheld IR Remotes + IR Receiver; Tones & Wireless Command Signals | Decode handheld IR remote signals to trigger wireless actions, custom audio alerts, and emergency siren tunes on piezo buzzers. |

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| **Class 12** | **Displays: 16×2 LCD & High-Contrast OLED Displays**16×2 Character LCD & 0.96" OLED (I2C); Text Formatting & Dynamic Sensor Telemetry | Interface I2C-based LCD screens and crisp OLED displays to show live graphics, text messages, and real-time sensor readings. |
| **Class 13** | **Precision Motion: Servo Kinematics**Micro Servo Motors; Angle Control & Joystick / Potentiometer Mapping | Drive micro servo motors to precise angles (0° to 180°) and turn a knob or move a joystick to control physical mechanical arms in real time. |
| **Class 14** | **Distance Sensing & Project 2: Digital Distance Meter**HC-SR04 Ultrasonic Sensor + OLED / LCD Display; Time-of-Flight Math & Spatial Telemetry | **Hands-On Build:** Use ultrasonic waves to measure distance like a bat and build a portable digital ruler/distance meter that displays real-time target distance on an OLED screen. |
| **Class 15** | **Motors & Speed Drivers**DC Motors & High-Current Motor Drivers (L298N/L293D); Controlling Direction & Wheel Speed | Learn how to safely drive high-power motors using motor drivers to flip rotation direction and control wheel speeds via PWM. |
| **Class 16** | **Optical Detection & Safety Switches**Infrared (IR) Track Sensors & Bumper Limit Switches; Tuning Sensitivity & Mechanical End-Stops | Use infrared light to detect black lines vs. white surfaces, and install safety bumper limit switches to detect physical collisions. |
| **Class 17** | **Project 3: Autonomous Line Follower (Part 1)**2WD Robot Chassis, Gear Motors, & Wheels; Battery Packs & Power Distribution | **Hands-On Build:** Assemble the robot frame, mount the dual motors and wheels, connect battery power rails, and align your optical line sensors. |

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| **Class 18** | **Project 3: Autonomous Line Follower (Part 2)**Dual IR Sensor Logic Matrix; Differential Steering Algorithms & Track Following | **Hands-On Build:** Write and tune differential steering code so your mobile robot follows a high-contrast black line track completely on its own! |
| **Class 19** | **Project 4: Dual-Mode Rover (Obstacle Avoiding + Wireless IR)**Ultrasonic Scanner + IR Remote + Motor Driver + 2WD Chassis; Self-Driving Evasion & Wireless Steering Logic | **Hands-On Build:** Combine ultrasonic scanning and wireless IR remote controls to build a multi-mode robot that can auto-navigate rooms or be driven manually via remote! |
| **Class 20** | **Grand Exhibition, System Debugging, & Graduation**Live Hardware Diagnostics & Fixing Loose Wiring; Project Showcase & Certification | Run your robots on live challenge tracks, debug edge cases under pressure like a pro engineer, showcase your work, and receive your course certificate! |