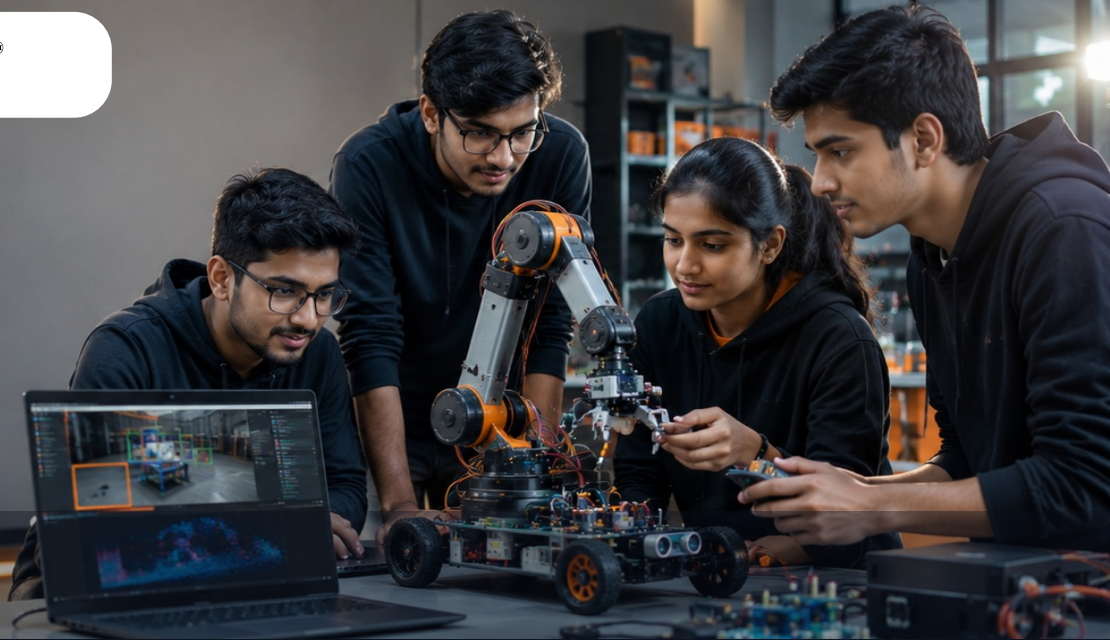




PROFESSIONAL CERTIFICATE PROGRAM

AI, Electronics & Robotics: From Circuits to Intelligent Systems

A hands-on engineering journey through electronics, embedded software, robot building, connected devices, and Edge AI.

6 MONTHS

48-50 CLASSES

INR 50,000

CURRICULUM GUIDE | ROBOTIC SIR AI INDIA PVT. LTD.

Build the complete engineering stack

This program develops practical engineering judgment from first principles. Students begin with discrete electronics, learn to program microcontrollers, build reliable power and motor systems, connect real sensors, and finish with wireless, PCB, computer vision, and Edge AI projects.

6 Months PROGRAM DURATION	48-50 HANDS-ON CLASSES	INR 50,000 PROGRAM FEE
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What learners will be able to do

01	Understand circuits from first principles Read, calculate, prototype, and troubleshoot AC/DC circuits using resistors, diodes, transistors, MOSFETs, regulators, relays, and electromagnetic components.
02	Program embedded control systems Use Arduino IDE and C/C++ logic to work with digital and analog I/O, PWM, serial debugging, data scaling, and conditional control.
03	Engineer reliable robot hardware Integrate microcontrollers, motors, H-bridge drivers, battery packs, BMS protection, mechanical chassis, and soldered assemblies.
04	Connect sensing, wireless, and display systems Build practical systems with environmental, motion, distance, sound, light, and touch sensors plus Wi-Fi, BLE, RF, OLED, and matrix displays.
05	Deliver portfolio-ready intelligent products Complete integrated projects spanning robotics, IoT dashboards, PCB design, smart access, computer vision, and Edge AI.
LEARNING FORMAT	Two classes per week, or one focused 2-hour class per week. Every stage combines theory, breadboarding, coding, soldering, testing, and debugging.

STAGE 1

Core Electronics & Semiconductors

Learn what happens inside a circuit before relying on ready-made modules. Students develop component-level intuition through measurement and physical builds.

MODULE	CONCEPTS	PRACTICAL BUILD
1. Resistance & Ohm's Law	Resistance, voltage, current, series and parallel networks, AC and DC basics.	LED networks and voltage measurement using multiple resistor values.
2. Diodes & Semiconductors	PN junctions, forward and reverse bias, and semiconductor behavior.	Diode circuits and an OR logic gate using diodes and resistors.
3. Zener Diodes	Reverse-bias regulation and voltage limiting.	3V and 5V regulator circuits plus resistor-based voltage reduction.
4. Light Dependent Resistors	Photoelectric response and light-controlled variable resistance.	Automatic LED and resistance variation experiment.
5. Transistors	Base, collector, emitter, switching, and basic hardware logic.	Touch sensor, automatic lamp, and transistor-based AND gate.
6. Optocouplers	Electrical isolation, safe signal transfer, and voltage-domain control.	Controlled voltage experiment and a homemade LED-LDR optocoupler.
7. MOSFETs	Gate, drain, source, gate capacitance, floating charge, and binary states.	1-bit physical memory cell - touch-and-lock human RAM.
8. Voltage Regulators	7805 and 7812 operation, thermal limits, and safe regulation.	5V regulated supply and a dual-voltage regulation system.
9. Magnetic Components	Electromagnetic induction, mutual induction, transformers, solenoids, and inductors.	Full-wave bridge rectifier and two-solenoid induction demonstration.
10. Relays	Electromagnetic switching and low-voltage control of high-voltage loads.	Relay switching circuit and automatic load control.

STAGE RESULT

Students can explain, assemble, measure, and troubleshoot practical circuits using discrete components - a foundation that makes later embedded-system work more reliable.

STAGE 2

AI, Python & Microcontroller Logic

Translate engineering ideas into reliable embedded software. The emphasis is on readable control logic, measurement, debugging, and real hardware behavior.

Programming foundations - Arduino IDE architecture and the setup() / loop() execution model - C and C++ syntax, variables, data types, and memory behavior - Serial Monitor and Serial Plotter debugging techniques - Digital I/O with pinMode(), digitalWrite(), and digitalRead()	Control and data handling - Hardware and software button debouncing - Analog input, ADC resolution, and PWM signal generation - Dynamic sensor scaling with map() - Conditional flow using if/else, switch, and logical AND/OR
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STAGE 3

Microcontrollers, Power & Robot Building

Combine programmable control, motion, safe power engineering, and physical assembly into functional robotic platforms.

MODULE	CONCEPTS	PRACTICAL BUILD
Programmable hardware	Arduino Uno R3 and Arduino Nano setup, pin planning, power, and upload workflow.	Bring-up and validation of both controller platforms.
Motors & actuation	500 RPM Johnson gear motors, standard DC and BO motors, servo control, and L298N dual H-bridge drivers.	Motor characterization and servo angle calibration rig.
Battery engineering	Lithium-ion chemistry, 18650/21700 sizing, CR2032 cells, and 3S 40A BMS architecture.	Custom 21700 battery pack with integrated protection.
Mechanical integration	Robot chassis layouts, cable management, connector selection, and serviceable assembly.	Dual-axis joystick controlled mobile base.
Soldering & transfer	Breadboard-to-zero-PCB transfer, solder joints, inspection, and practical rework.	Permanent circuit assembly and functional test.

DESIGN HABIT

Every build is treated as a system: power budget, signal integrity, mechanical load, code behavior, and safe troubleshooting are considered together.

STAGE 4

Sensor Physics & Practical Modules

Learn how real-world signals are detected, conditioned, interpreted, and converted into dependable automated behavior.

Light & vision - LDR SMD sensors - Laser emitting modules - RGB color sensing	Presence & distance - IR sensors - DIP and SMD - Ultrasonic distance sensing - Capacitive touch modules
Environment - DHT11 temperature and humidity - Flame and heat detection - Microphone sound sensing	Motion & state - Vibration sensing - Tilt sensing - Magnetic Hall-effect sensing

Six practical systems

PROJECT 01 Regulated power station Build and validate a stable 5V bench supply for sensor and logic experiments.	PROJECT 02 AC-to-DC distribution board Convert 240V AC to low-voltage DC with disciplined isolation and distribution.
PROJECT 03 Laser tripwire alarm Create a perimeter security system using aligned optical sensing and alarm logic.	PROJECT 04 Binary memory cell Implement a hardware-level toggle state using semiconductor switching behavior.
PROJECT 05 Touch-activated circuit Translate capacitive or transistor-based touch input into a reliable output action.	PROJECT 06 Discrete logic gates Build AND, OR, and NOT functions from diodes and transistors.

PRACTICAL EMPHASIS

Students compare sensor limits, noise, calibration, thresholds, false triggers, and the difference between a demo that works once and a system that works repeatedly.

STAGE 5

Wireless Integration & Edge AI

Bring sensing, control, connectivity, visualization, and intelligent perception together in complete connected products.

MODULE	CONCEPTS	PRACTICAL BUILD
Connected controllers	ESP32-class microcontrollers, local Wi-Fi servers, Bluetooth Low Energy, and long-range RF links.	Reliable device-to-device and device-to-dashboard communication.
Displays & remote input	OLED graphics, rotary encoders, 8x8 dot matrix displays, IR receivers/remotes, and PlayStation controller protocols.	Interactive local interfaces and remote robot control.
PCB design	Schematic capture, board layout, connector planning, power distribution, and design-for-assembly.	Transfer an integrated circuit from prototype to a purpose-built PCB.
Edge AI & vision	Real-time video processing, computer vision model workflows, and local inference constraints.	Perception-driven automation running close to the device.

Integrated portfolio projects

01

Smart RFID access gate

Build an encrypted identity-driven security gate with controlled actuation and access feedback.

02

Wireless heavy robotics chassis

Use a PlayStation controller interface to operate a high-torque mobile platform.

03

IR matrix graphics & gaming

Control 8x8 dot-matrix graphics and simple game interactions through an IR remote.

04

ESP32 weather dashboard

Stream environmental sensor data to a smart IoT dashboard over Wi-Fi.

05

OLED AQI system with PCB

Measure air quality, present live results on OLED, and integrate the design on a custom PCB.

Program plan & hardware kit

The schedule preserves enough time for hands-on assembly, soldering, coding, measurement, and debugging. Class counts may shift slightly based on project complexity and learner pace.

STAGE	FOCUS AREA	ESTIMATED CLASSES
Stage 1	Core electronics and discrete components	8-10
Stage 2	AI, Python, and microcontroller software logic	8-10
Stage 3	Microcontrollers, battery packs, motors, and assembly	8-10
Stage 4	Sensor physics, modules, and six practical projects	10-12
Stage 5	Wireless systems, displays, PCB design, and Edge AI	10-12
TOTAL	Full-stack hardware and embedded systems	48-50

Hardware kit included

Electronics - Resistors, diodes, Zener diodes - Transistors, MOSFETs, relays - Regulators, inductors, solenoids	Controllers & connectivity - Arduino Uno and Nano boards - ESP32 modules - Wireless and display modules	Power & motion - 21700 cells and 3S BMS - DC, BO, gear, and servo motors - L298N motor drivers
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The learner journey

UNDERSTAND Physics & components	PROGRAM Logic & control	BUILD Power & mechanics	CONNECT Sensors & wireless	INTELLIGENT Vision & Edge AI
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READY TO BUILD?

Learn by designing, testing, debugging, and improving real systems.

roboticsir.in | ai@roboticsir.com

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