

**P. T. Sarvajanik College of Science
Surat**

(Affiliated to the Veer Narmad South Gujarat University, Surat)

**Syllabus for Skill based
Certificate Course in Arduino Programming and Interfacing**

2 Credits Course

Total Contact hours: – 30



Certificate Course in Arduino Programming and Interfacing

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Course Outcomes:

After successful completion of the course a student will be:

1. able to understand embedded systems and their various variations
2. write programs to control an Arduino board
3. design an embedded system for automation
4. design a professional embedded system with sensors for industrial use.

Pre-requisites:

1. Elementary mathematics of secondary level
2. Knowledge of a programming language (not mandatory)
3. Enthusiasm to learn by doing it yourself (DIY).

Eligibility:

High school, College and PG students.

Unit 1

Embedded Systems: 1 hour

Main Components of Embedded Systems, Constraints of Embedded Systems, Concepts of microprocessor and microcontroller and other Elements of Embedded Systems. What is a Program/Software/Simulator/Compiler and its applications within Embedded Systems.

Basic electrical theory and electronic components: 3 hours

Basics of Voltage (AC & DC), current, power. Passive components - resistors, inductors and capacitors. Active components – diodes, transistors, MOSFETs, integrated circuits (analog and digital).

Interfacing techniques: 2 hours

Breadboard fundamentals and usage. PCB and using general purpose PCB. Soldering techniques and hands on practice.

Binary numbers and logical and arithmetic operations. Hexadecimal number system.

2 hours

Unit 2

Microcontroller Fundamentals: 2 hours

Microcontrollers, Programming Microcontrollers, Arduino Platform, The Boards, The Anatomy of an Arduino Board, The Development Environment

Arduino Board and its components: 1 hours

Learning about Analog, Digital, Power, Other Pins, External/USB power supply, reset button, and other components of Arduino Board



Arduino Library and Emulator 1 hour
Learning about the standard library of Arduino, adding libraries from external sources (GitHub).

Writing Arduino Programs 3 hours
Acquiring the skills for writing Arduino Sketches, working with examples, interfacing some components like LED, switch and buzzer with Arduino, Serial Monitor of Arduino IDE.

Unit 3

Sensor Fundamentals 4 hours
How Sensors Work, Analog and Digital Sensors, Pull-Up/Down resistors and Examples of sensors, Connecting different sensors such as: Humidity, Heat/Temperature, proximity, IR Motion, Accelerometer, Sound, Light, distance, Pressure, Thermal, Infrared, LDR etc. to Arduino Board

LCD 2 hours
Working on LCD, Reading Various Sensor data on Serial Monitor and LCD

Voltage regulators 1 hour
Using different types of voltage regulators, identifying modules for step up / step down voltage conversion, interfacing sensors with different voltage requirements.

Unit 4

Actuators 2 hours
Actuators, Relay Switch, Motors (DC, Servo and Stepper),

Troubleshooting and debugging: 1 hour
Commenting out code for software problems, identifying and isolating circuit components for hardware related problems.

ADC and PWM: 1 hour
Using ADC for sensing analog signals. Generating analog voltages using PWM, Putting Things Together, Sensing the World, Reading from Analog Sensors.

Wireless and IoT: 4 hours
Brief fundamentals of Bluetooth, GSM, Wi-Fi technologies. Various ESP8266 modules and their uses. Substituting Arduino board with a Nodemcu or ESP32.



Recommended reference books:

1. Arduino For Dummies, John Nussey , 2nd Edition Published by: John Wiley & Sons,
2. Arduino Essentials, Francis Perea, Packt Publishing
3. Arduino for Beginners: Essential Skills Every Maker Needs, John Baichtal Published by Que Publishing
4. <https://www.tutorialspoint.com/arduino/index.htm>

Suggested teaching methodology:

Unit 1 is to be taught as a classroom lecture since it involves theoretical knowledge to be imparted to students.

Units 2-4 are to be taught with hands on method and use of a blackboard / whiteboard or PowerPoint slides as and where necessary.

Examination:

The candidates shall be examined practically. They shall be required to design and build a project that uses an Arduino (any model) / NodeMcu / ESP8266 / ESP32. The board should be interfaced with minimum two objects – an input device (like a sensor) and an output device (motor, solenoid, LCD, speaker etc.)

The project must be submitted within 10 days of completion of course by the instructors.

The submission should be on the same day for all the candidates (15 candidates per day).

The candidates will have to appear for a viva voce while submitting the project.

The examiner will mark the candidates based on their performance. The suggested marking scheme is given below.

Attendance	10%
Performance during hands on sessions	20%
Project	40%
Viva Voce	30%
Total	100%

Total marks of the examination should not be less than 100. It is recommended to keep it at 200.

In order to successfully pass in the examination, a candidate must score minimum **40%** of the total marks.

