B. Sc. Physical Sciences with Electronics as one of the Core Disciplines

SKILL BASED COURSE – SBC 7-1: ARDUINO PROGRAMMING

Course Title and Code	Credits	Credit distribution of the course			Pre-requisite of the course
		Lecture	Tutorial	Practical	
Arduino Programming SBC 7-1	2	0	0	2	

COURSE OBJECTIVES

- To introduce students to the fundamentals of embedded systems using the Arduino platform.
- To develop programming skills in C/C++ for microcontroller-based applications.
- To foster logical thinking and problem-solving through real-world electronic projects.
- To lay the foundation for interfacing sensors and actuators using digital and analog I/O.

LEARNING OUTCOMES

- Explain the architecture and features of the Arduino Platform.
- Set up and use the Arduino IDE to write, debug using Serial Monitor, and upload code to an Arduino board.
- Write basic programs involving digital and analog I/O, loops, functions, and conditional statements.
- Implement simple tasks such as blinking LEDs, reading buttons, generating PWM signals, and reading analog voltages.
- Understand serial communication and use the Serial Monitor for debugging.
- Design small-scale automation and control programs using Arduino logic.

SYLLABUS OF SBC 7-1
(Hours: 60)

Unit I **(24 Hours)**

Introduction to Arduino

- Overview of Arduino and its applications.
- Understanding microcontrollers and development boards.

- Introduction to the Arduino IDE.
- Installing the Arduino IDE.
- Connecting Arduino to your computer.
- First program: Blink an LED (Hello World of Arduino).

Basic Electronic Components

- Basic concepts of electronic components- Resistors, capacitors, diodes, transistors, LEDs.
- Breadboards and prototyping techniques.
- Ohm's Law and calculating resistor values for LEDs.
- Controlling LEDs with Arduino.
- Switches and Buttons: Digital inputs and outputs. Using push buttons with Arduino.

Unit II **(36 Hours)**

Programming Fundamentals

- Arduino Programming Basics: Structure of an Arduino sketch (setup and loop functions), Variables, data types, and operators.
- Control Structures: Conditional statements (if, else, switch). Loops (for, while, do-while).
- Functions and Libraries: Writing and using functions. Introduction to Arduino libraries.
- Debugging and Troubleshooting: Common errors and debugging techniques. Serial communication (Serial Monitor) for debugging.

List of Experiments

1. Blink an LED. Also modify blink rate.
2. Button-Controlled LED. Turn an LED on/off using a push button.
3. Debounce a Button. Implement debounce to handle noisy button presses.
4. LED Fading to control LED brightness.
5. Potentiometer-Controlled LED. Adjust LED brightness using potentiometer and analog Read().
6. Serial Monitor Interaction. Display text and sensor readings on the Serial Monitor. 16x2 LCD Display. Display "Hello, World!" and temperature data.

Project-based learning to be encouraged.

SUGGESTED READINGS

"Getting Started With Arduino" By Massimo Banzi and Michael Shiloh. Shroff/Maker Media; fourth edition (2022). ISBN-13 : 978-9391043858