Nirma University

Institute of Technology

Electronics and Communication Department

Course Policy

B. Tech. Semester VII **Academic Year: 2022-23**

Course Code & Name	:	2ECOE53 – Arduino for Engineers
Credit Details	:	L T P C 2 - 2 3
Course Coordinator	:	Prof. Dhaval Shah
Contact No. & Email	:	Contact: 079-71642422 Email: dhaval.shah@nirmauni.ac.in
Office	:	New Building-11th Floor Faculty Room
Visiting Hours	:	08:45 am to 4:00 pm
Course Blog	:	LMS course page
Course Faculty	:	Dr. Akash Mecwan
Contact No. & Email	:	Contact: 079-71642410 (Office) Email: akash.mecwan@nirmauni.ac.in
Office	:	D-201 Analog Lab
Visiting Hours	:	08:45 am to 4:00 pm
Course Faculty	:	Prof. Hardik Joshi
Contact No. & Email	:	Contact: 079-71642409(Office) Email: Hardik.joshi@nirmauni.ac.in
Office	:	D-206 Digital Lab
Visiting Hours	:	08:45 am to 4:00 pm

1. Introduction to Course

1.1 Importance of the course

Arduino provides open source hardware-software platform to develop a controller based applications in the different filed of engineering. Learning of this, helps the student to develop standalone product or an application in their respective field. This course provides adequate learning for the same.

1.2 Objective of the Course

The main objective of the course is to learn the different IO interfacing of Arduino board with analog and digital devices. This will help the students to develop a project in their respective engineering field.

1.3 Pre-requisite:

Students are expected to review these concepts before coming to class:

The knowledge of basic of c programming is prerequisite requirement of this course.

2. Course Outcomes (CO)*

COs are clear statements of the expectations for student achievements in the course.

After successful completion of this course, students will be able to

1. Demonstrate programming proficiency using Embedded C for Arduino
2. Interface Analog and Digital peripherals with Arduino
3. Establish serial communication using I2C and SPI protocol
4. Demonstrate proficiency in developing Arduino based applications

3. Syllabus

Syllabus:	**Teaching Hours: 30 hrs**
UNIT-I: Introduction to Arduino board and Programming The Arduino family, Arduino Uno board, Atmega328p Microcontroller, Programming using Arduino IDE	**05**
UNIT-II: I/O Programming and Interfacing LED, push-button switch, Hex keypad, Seven segment display, LCD interfacing	**05**

UNIT-III: Serial Communication Basics of serial communication, Asynchronous serial communication and data framing, Serial port programming, I2C and SPI communications, LCD interfacing using I2C	**06**
UNIT-IV: Motor Control Interfacing of DC and Stepper motor, PWM for motor speed control, Relays	**06**
UNIT-V: DAC and Sensor Interfacing to Arduino Board DAC interfacing, Ultrasonic distance sensor, Humidity and temperature sensor, Infrared sensor, Light sensor (LDR), Wifi and Bluetooth module	**08**

3.1. Self-Study

The self-study components of the syllabus are declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content. Topics/content for self-study are as listed below:

- Adding a library

Students are expected to study above mentioned topics on their own. These topics will not be taught in the classroom. Students should refer to books available in the library for the same.

3.2. References

1. Simon Monk, Programming Arduino Getting Started with Sketches, McGraw Hill
2. Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, Wiley Publishers
3. Michael Margolis, Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects, Oreilly Media
4. Muhammad Mazidi, The 8051 Microcontroller and Embedded Systems using Assembly and C, Pearson Edu.

Note: The latest edition of books should be referred.

4. Laboratory details

Laboratory experiments/ exercises should be completed as per the given schedule. It is expected that a student does the same with full understanding of the concept, procedure and application involved.

Laboratory work will be based on above syllabus with following 10 experiments to be performed.

Sr. No.	Week No. #	Title	Mapped CO
1.	1	Introduction to Arduino boards and Arduino IDE	1
2.	2	To Utilize Digital Input-Output pins of Arduino board.	1,2,4
3.	3,4	To Utilize Analog Input-Output pins of Arduino board.	1,2,4
4.	5,6	To perform serial communication with Arduino	1,3,4
5.	6	To interface LCD display	1,2,4
6.	7,8	To establish communication using I2C protocol	1,3,4
7.	8, 9	To control the speed of DC motor	1,2,4
8.	10,11	To control the speed of servo motor	1,2,4
9.	12,13	Handling external interrupt with Arduino	1,2,4
10.	14,15	Adding an external library to Arduino environment	1,4

5. Assessment Policy

5.1 Component wise Continuous Evaluation (CE), Laboratory and Project Work (LPW) & Semester End Examination (SEE) weightage

Assessment scheme	**CE(100 Marks)**			**LPW (100 Marks)**		**SEE (100 Marks)**
Component weightage	0.4			0.2		0.4
	Test -1 35% (Maximum 35 Marks)	Test -2 35% (Maximum 35 Marks))	Special Assignment 30% (Maximum 30 Marks)	Continuous Evaluation 75% (Maximum 75 Marks)	Viva Voce 25% (Maximum 25 Marks)	(Guidelines will be given)

5.2 Assessment Policy for Continuous Evaluation (CE)

Assessment of Continuous Evaluation comprises of three components.

1. Test-1 will be conducted as per academic calendar. It will be pen paper for the duration of 1 hour and 15 minutes and will be of 35 marks.
2. Test-2 will be conducted as per academic calendar. It will be pen MCQ types paper for the duration of 1 hour and 15 minutes and will be of 35 marks.
3. As a part of special assignment, students are expected to design a Arduino based project (in group of two) which may or may not be from the syllabus. Students will be informed at the beginning of semester. The submission of the same has to be done between 12th to 14th week of academic calendar

5.3 Assessment Policy for Laboratory and Project Work (LPW)

Assessment of Laboratory and Project Work comprises of two components.

1. Continuous assessment for laboratory experiments will be conducted. There will be 10 experiments, each of them carries 10 marks weigtage. At the end of the course total marks obtained out of 100 will be converted according to weightage assigned. Assessment of Experiment will be carried out based on parameters like Completion of lab work file, understanding of the experiment performed, originality, involvement of the student, regularity, discipline etc. during the session.
2. A Viva voce examination for LPW component will be conducted as per academic calendar. It will carry a weightage of 25 marks.

5.4 Assessment Policy for Semester End Examination (SEE)

The Guideline for the same will be circulated later by Exam section, IT-NU

5. Lesson Plan

Lecture No	Topics	Mapped COs
1-2	Basics of Microcontroller :The Arduino family, Arduino Uno board,	1,4
3-4	Atmega328p Microcontroller	1,4
5	Programming using Arduino IDE	1,4
6	LED and push-button switch interfacing,	1,2
7	Hex keypad interfacing	1,2

8	Seven segment display	1,2
9-10	LCD interfacing	1,2
11	Basics of serial communication, Asynchronous serial communication and data framing,	3
12	Serial port programming	3
13-15	I2C and SPI communications,	3
16	LCD interfacing using I2C	3
17-19	Interfacing of DC and Stepper motor	1,2
20-22	PWM for motor speed control, Relays	1,2
23	DAC interfacing,	1,2,4
24-30	Ultrasonic distance sensor, Humidity and temperature sensor, Infrared sensor, Light sensor (LDR), Wifi and Bluetooth module	1,2,4

7. Mapping of Session Learning Outcomes (SLO) with Course Outcomes (CO)

Session No.	**Session Learning Outcomes: After successful completion of the session, student will be able to**	**Mapped CO**
1-2	Understand the Arduino Uno pin functionality	1,4
3-4	Understand the basic of controller	1,4
5	Learn the data types, operators and syntax of Arduino programming	1,4
6	Interface the LED and push-button,	1,2
7	Interface Hex keypad	1,2
8	Interface Seven segment display	1,2
9-10	Interface LCD using GPIO	1,2
11	Differentiate between synchronous and asynchronous serial communication	3
12	Program Serial port	3

13-15	Understand I2C and SPI communications protocols	3
16	Interface LCD interfacing using I2C protocol	3
17-19	Interfacing of DC and Stepper motor	1,2
20-22	PWM for motor speed control, Relays	1,2
23	Understand the concept of digital to analog conversion	1,2,4
24-30	Interface different sensor with Arduino board to develop an application	1,2,4

8. Teaching-learning methodology

1. Lectures: It will be conducted over WebEx platform in which white board and power point presentation will be used to conduct the course. However, where required, simulations / Animations etc. will be used to enhance the teaching-learning process.
2. Laboratory: Explanation of Experiment to be performed along with co-relation with theory will be given. At the end of each session assessment will be carried out based on parameters like completion of lab work that includes observations, codes, flowchart and conclusions, individuality and involvement of the student, regularity, discipline etc. Students will be quizzed to check their understanding of the experiment/exercise conducted.

9. Active learning techniques

Active learning is a method of learning in which students are actively or experientially involved in the learning process. Following active learning techniques will be adopted for the course.

1. Muddiest topic:
   This technique is aimed at finding out the least understood point/topic in the session. This is then further explained to ensure that it is understood well.

2. Technical word discussion:
   After every 10-12 lectures, list technical word, which have study in this subject. Ask to to students, if not much knowledge of that word than elaborate that technical word in form of definition or some mathematical proof.

10. Course Material

Following course material is uploaded LMS course page

- Course Policy
- Lecture Notes
- Books / Reference Books / NPTEL video lectures
- Assignments, Tutorials, Lab Manuals
- Question bank
- Web-links, Blogs, Video Lectures, Journals
- Animations /Simulations, Softwares
- Advanced topics

11. Course Outcome Attainment

Following means will be used to assess attainment of Course outcomes.

- Use of formal evaluation components of continuous evaluation, tutorials, laboratory work, semester end examination
- Informal feedback during course conduction

12. Academic Integrity Statement

Students are expected to carry out assigned work under Continuous Evaluation (CE) component and LPW component independently. Copying in any form is not acceptable and will invite strict disciplinary action. Evaluation of corresponding component will be affected proportionately in such cases. Turnitin software will be used to check plagiarism wherever applicable. Academic integrity is expected from students in all components of course assessment.