



**Gyanmanjari**  
Innovative University

Course Syllabus  
Gyanmanjari Science College  
Semester-3 (M.Sc.)

**Subject:** Physical Computing-MSCPH13515

**Type of course:** Major

**Prerequisite:** Knowledge of Analog and Digital Electronics, C-Programming and basic Computer operations.

**Rationale:** The course is designed to building and using interactive systems using hardware and software responding to various stimuli, Understanding the role of modern microcomputers in the control and measurement applications, the learner would be introduced to various measurement and interfacing techniques used in Industrial and Laboratory environments.

#### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

*Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V -- Viva; CA - Continuous Assessment; ALA- Active Learning Activities.*

#### Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	<b>Blink it Like You Mean It</b> Student have to Create a blinking LED program using variables and loops, and test it on your Arduino board and upload its output on GMIU web portal.	10
2	<b>Serial Talk with Arduino</b> Student have to Write a program to control an LED or buzzer by receiving characters from the Serial Monitor and upload its output on GMIU web portal.	10
3	<b>Hot or Not? Show It on LCD</b> Student have to Connect a temperature sensor and display the live temperature with warning messages on a 16x2 LCD and upload its output on GMIU web portal.	10



4	<b>Time to Spin – Motor on Schedule</b> Student have to Build a system to run a DC motor for 5 seconds and stop it for 3 seconds repeatedly using the Millis() function and upload its output on GMIU web portal.	10
5	<b>Reactor in Action – Virtual Lab</b> Student have to Use an online simulation tool to explore how a nuclear fission reactor works and submit your observations in a report and upload it to GMIU web Portal.	10
<b>Total</b>		<b>50</b>

**Course Content:**

Unit No	Course content	Hrs	% Weightage
1	<b>Chapter-1</b> Introduction to Arduino, types of Arduino boards and their capabilities, IDE, Structure of Arduino Program, Creating Uploading and Executing Arduino Programs. Arduino Programming: Variables, Arrays, Arduino String and C character strings, handling strings, Functions, Return values, Conditional actions, Looping, Comparisons. Mathematical operations: Basic operations, trigonometric operations, Random number handling, Bit operations, Byte operations.	15	25%
2	<b>Chapter-2</b> Serial Communication: Receiving and Transmitting serial information to and from Arduino, controlling Arduino from data received. Digital and Analog Input/Output: Connecting Switches to Arduino, connecting and programming a Keypad, analog input, multiple digital and analog inputs, higher analog inputs.	15	25%
3	<b>Chapter-3</b> Sensor connection and programming: for movement, light, motion, distance, vibration, sound, temperature, RFID, rotary movements, interrupt driven sensing, mouse, GPS, gyroscope, direction, acceleration. Visual outputs: LED, LED Matrix, Charlieplexing, 7 segment LED, Multi-digit display, PWM extender, analog meter connection. LCD Text display connection and programming for message display, formatted text display, cursor control, scrolling messages, special symbol display, creating and displaying custom characters, Graphical LCDs, Bitmap creation and display.	15	25%





4	<b>Chapter-4</b> Physical Outputs: connecting and controlling Single and Multiple servo motors, controlling direction and speed of DC motors, interfacing and controlling unipolar and bipolar stepper motors. Audio output from Arduino using Tone function, melody generation, playing WAV, Midi control. Time and Date management with Arduino: delays, Millis function, precise time measurement, software clock and hardware real time clock, periodic function execution.	15	25%
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### Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	40%	30%	10%	-	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

### Course Outcome:

After learning the course the students should be able to:	
CO1	program Arduino using variables, functions, loops, and perform basic mathematical operations.
CO2	interface digital/analog components and manage serial communication with external devices.
CO3	connect sensors and display data on various visual outputs like LEDs and LCDs.
CO4	control motors, generate audio, and implement precise timing using Arduino functions.

### Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory



The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

### Reference Books:

- [1] Arduino Cookbook: Michael Margolis, (O'Reilly Pub., Shroff Publishers)
- [2] Getting started with Arduino: Massimo Banzi (O'Reilly Publication)
- [3] Beginning C for Arduino: Jack Purdum, Apress (Springer)
- [4] Arduino Programming Notebook: Brian W Evans; Online at [www.arduino.cc](http://www.arduino.cc)
- [5] Arduino online manuals at [www.arduino.cc](http://www.arduino.cc) 6. Exploring Arduino: Jeremy Blum (Wiley)

