

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
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Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance : 5 marks

Continuous Assessment : 25 marks

Lab Examination: 10 marks

SYLLABUS**Module 1 (14 Hrs)**

Arduino Basics: Arduino Uno R3 components, Microcontrollers in other Arduinos, Programming Interfaces, Input/Output: GPIO, ADCs, and Communication Busses, Bootloaders and Firmware. Digital Inputs, Outputs and PWM: Digital Outputs, Controlling an LED on a breadboard with digitalWrite, Controlling an RGB LED, Pulse-Width Modulation with analogWrite, Reading Digital Inputs, Pull-Down Resistors, Using Internal Pull-Up, Contact Bounce Elimination Interfacing Analog Sensors: Analog and Digital Signals, Converting an Analog Signal to Digital, ADC Resolution and Quantization, Reading Analog Sensors using analogRead, Using Analog Inputs to Control Analog Outputs.

Module 2 (14 Hrs)

Using Transistors and Driving DC Motors: Driving DC Motors with Transistor, Protection Diodes, Controlling Motor Speed with PWM, H-Bridge to Control DC Motor Direction, Roving Robot, Powering Geared Motor with 7805 Regulator, Robot Hardware and Software Driving Stepper and Servo Motors: Driving Servo Motors, Controlling a Servo, Driving Stepper Motors, Bipolar Stepper Motors Working.

Module 3 (14 Hrs)

Serial Communication: Serial Data Communication between Serial Monitor and Arduino, Software Serial I2C: I2C Hardware Design, Communication Scheme and ID Numbers, Hardware Requirements and Pull-Up Resistors, Communicating with an I2C Temperature Probe. PI: SPI Hardware Configuration, Communication Scheme, Comparing SPI to I2C and UART, Communicating with an SPI Accelerometer.

Module 4 (14 Hrs)

Sounds: Making Sound Using tone and Speaker, Making Sound Sequences Interrupts: Hardware Interrupts, Trade-offs Between Polling and Interrupting, Arduino Hardware Interrupt Capabilities, Hardware Debounced Button Interrupt Circuit, Hardware interrupt example code, Timer Interrupts, Timer interrupt example.

Text Books

1. Blum, J. (2020). *Exploring Arduino* (2nd ed.). Wiley.
2. Margolis, M., Jepson, B., & Weldin, B. (2020). *Arduino cookbook* (3rd ed.). O'Reilly Media.
3. Ayala, K. J., & Gadre, D. V. (2010). *The 8051 microcontroller: Architecture, programming and applications*. Cengage Learning.

Reference Books

1. Hughes, J. M. (2016). *Arduino: A technical reference* (1st ed.). O'Reilly Media.
2. Uma Rao, K., & Pallavi, A. (2011). *The 8051 microcontrollers: Architecture, programming and applications*. Pearson Education.
3. Intel Corporation. (1992). *8051 hardware description: Datasheet*. Intel Corporation.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

Course Code	25MECT401
Course Name	FUNDAMENTALS OF MICROCONTROLLERS AND APPLICATIONS
Max. Marks: 60	Duration: 2.5 Hours

Part A <i>(Answer all questions. Each question carries 3 marks)</i>				
Qn No.	Question	Marks	CO	BL
1	A digital sensor is connected to an Arduino input pin. Explain the purpose of internal pull-up resistors.	3	CO1	L2
2	A temperature sensor provides analog voltage to an Arduino. Explain the conversion of an analog signal into a digital value.	3	CO1	L2
3	A small DC motor is controlled using an Arduino. Explain the need of a transistor to drive the motor.	3	CO2	L2
4	A robotic arm requires precise angular movement. Elaborate the working of a servo motor.	3	CO2	L2
5	An Arduino is connected to a PC to display temperature sensor readings. Describe the communication interface used and explain its operation.	3	CO3	L2
6	A weather station uses multiple sensors connected to the same communication bus. Explain the appropriate communication protocol and explain why it is suitable.	3	CO3	L2

7	An embedded system continuously checks the status of a push button. Differentiate between polling and interrupts.	3	CO4	L2
8	A melody player is developed using Arduino and a speaker. Explain how sound sequences are generated.	3	CO4	L2
Part B <i>(Answer any one full question from each Module. Each carries 9 marks)</i>				
Qn No.	Question	Marks	CO	BL
Module I				
9.	A smart home controller is designed using an Arduino Uno board to read sensor inputs and control LEDs. Explain the architecture of the Arduino Uno R3, including GPIO pins, ADC, communication buses, bootloader, and firmware.	9	CO1	L2
OR				
10.	A smart lighting system varies LED brightness based on ambient light intensity. Explain digital inputs, digital outputs, PWM, analog inputs, and analog-to-digital conversion in Arduino with suitable examples.	9	CO1	L2
Module II				
11.	An automated robotic arm uses both servo motors and stepper motors. Explain the construction, operation, and control of servo motors and bipolar stepper motors using Arduino.	5	CO2	L2
OR				
12.	A line-following robot requires controlled movement and reliable motor operation. Elucidate the hardware and software requirements for driving DC motors using Arduino.	5	CO2	L2
Module III				
13.	An Arduino is connected to a PC to display temperature sensor readings. Apply a suitable communication interface and explain its operation.	9	CO3	L3
OR				
14.	Design an Arduino-based temperature monitoring system that communicates with an I2C temperature sensor. Explain the hardware requirements, communication scheme, addressing, and pull-up resistors used.	9	CO3	L3
Module IV				
15. a	An industrial automation system must respond instantly to emergency stop signals. Describe the advantages of interrupts over polling and explain Arduino hardware interrupt capabilities with suitable examples.	5	CO4	L2

15. b	A traffic monitoring system must immediately respond when a pedestrian button is pressed. Explain the purpose of hardware interrupts.	4	CO4	L2
OR				
16.	A digital clock is implemented using Arduino. Explain the concept of timer interrupts and discuss their implementation with suitable examples.	9	CO4	L2
