SEMESTER S5

MICROCONTROLLER LAB

Course Code	**PCMRL508**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PCMRT403	**Course Type**	Lab

Course Objectives:

1. Familiarize the students with Assembly Language Programming of modern microcontrollers.
2. Impart the skills for interfacing the microcontroller with the help of Embedded C/Assembly Language Programming.

Expt. No.	Experiments
1	Data transfer/exchange between specified memory locations.
2	Largest/smallest from a series.
3	Sorting (Ascending/Descending) of data.
4	Addition / subtraction / multiplication / division of 8/16 bit data.
5	Sum of a series of 8 bit data.
6	Multiplication by shift and add method.
7	Code conversion – Hex to Decimal/ASCII to Decimal and vice versa.
8	Time delay generation and relay interface.
9	Display (LED/Seven segments/LCD) and keyboard interface.
10	DAC interface with wave form generation.
11	Stepper motor and DC motor interface.
12	Realization of Boolean expression through port.

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Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

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- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Demonstrate the ability to transfer, manipulate, and exchange data between specified memory locations, and perform arithmetic operations on 8-bit and 16-bit data using a microcontroller.	**K3**
CO2	Develop and implement algorithms for sorting data in ascending and descending order, finding the largest and smallest elements in a series, and calculating the sum of a series of 8-bit data efficiently on a microcontroller.	**K6**
CO3	Design and implement interfaces for various peripherals, such as LED, seven-segment displays, LCDs, keyboards, DACs for waveform generation, and motors (stepper and DC motors), and generate appropriate time delays and relay control signals.	**K6**
CO4	Execute code conversion between different number systems (Hex to Decimal, ASCII to Decimal, and vice versa) and understand the significance of various data representations in microcontroller programming.	**KK3**
CO5	Realize and implement Boolean expressions through microcontroller ports, demonstrating the ability to design and control logical operations in embedded systems.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

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CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			2							
CO2	3	3	2		2							
CO3	3	2	3	2	3				2			
CO4	3				2							2
CO5	3	2	2		2				2			

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The 8051 microcontroller and Embedded System	Muhammed Ali Mazidi & Janice Gilli Mazidi, R.D. Kinley	Pearson Education	2nd edition, 2007
2	Computer Architecture and Organization: From 8085 to Core2Duo and beyond	Subrata Ghoshal	Pearson	1st edition, 2011
3	ARM System - on-chip Architecture	Steve Furber	Pearson Education	2014

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer System Architecture	Mano M M	Prentice Hall of India	3rd Edition, 2017
2	Computer organization and design: The Hardware/Software interface	David A. Patterson, John L. Hennessy	Elsevier	6th edition. 2021
3	Computer Organisation	V. Carl Hamacher, Zvonko G. Vranesic, Safwat G.Zaky	McGraw-Hill Education	5th edition, 2017
4	8085 Microprocessor Architecture, Applications and Programming	Ramesh S Goankar	Penram International	5/e

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
Module - I	https://archive.nptel.ac.in/courses/106/108/106108100/
Module - II	https://archive.nptel.ac.in/courses/106/108/106108100/
Module - III	https://archive.nptel.ac.in/courses/106/108/106108100/
Module - IV	https://archive.nptel.ac.in/courses/106/108/106108100/

Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 Marks)**
    - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
    - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.
2. **Conduct of Experiments (7 Marks)**
    - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
    - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
    - Teamwork: Collaboration and participation in group experiments.
3. **Lab Reports and Record Keeping (6 Marks)**
    - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
    - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.
4. **Viva Voce (5 Marks)**
    - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

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Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**
    - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
    - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.

- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**

   - Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. **Result with Valid Inference/Quality of Output (10 Marks)**

   - Accuracy of Results: Precision and correctness of the obtained results.
   - Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. **Viva Voce (10 Marks)**

   - Ability to explain the experiment, procedure results and answer related questions
   - Proficiency in answering questions related to theoretical and practical aspects of the subject.

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5. **Record (5 Marks)**

   - Completeness, clarity, and accuracy of the lab record submitted