SEMESTER S4

MICROCONTROLLER LAB

Course Code	**PCECL408**	**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)	PCECL307-Logic Circuit Design and Simulation Lab	**Course Type**	Lab

Course Objectives:

1. To learn Microcontroller Programming using Assembly and C language
2. To learn Microcontroller interfaces to various modules
3. To learn any advanced microcontrollers like ARM or higher.
4. To learn Embedded System Design

Details of Experiment

Expt. No.	Experiments
	PART A – Data manipulation experiments using Assembly language(Min 4 has to be completed)
1	Multiplication of two 16-bit numbers.
2	Largest/smallest from a series.
3	Sorting (Ascending/Descending) of data.
4	Matrix addition.
5	LCM and HCF of two 8-bit numbers.
6	Code conversion – Hex to Decimal/ASCII to Decimal and vice versa.
	PART B - Interface to Microcontroller Assembly/C language (Min 3 has to be completed)
1	Time delay generation and relay interface.
2	Display (LED/Seven segments/LCD) and keyboard interface.
3	ADC interface.
4	DAC interface with waveform generation.
5	Stepper motor and DC motor interface.

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	PART C - Interface with Advanced Microcontroller using C language (Min 3 has to be completed)
1	PWM generation for DC motor control.
2	Object/Visitor Counter.
3	UART interface to Bluetooth.
4	SPI/I2C interface to display.
5	Real-time clock.

* A minimum of 12 experiments is to be completed.

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**

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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**

- ***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	Develop 8051 Microcontroller programs	**K4**
CO2	Design and implement various interfaces to the 8051 Microcontroller	**K4**
CO3	Design and implement an Embedded System using a 8051 microcontroller	**K4**
CO4	Design and implement an Embedded System using an ARM processor	**K4**

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

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	2								2
CO2	3	3	3	2	3			2				2
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3

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

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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 Systems Using Assembly and C	Muhammad Ali Mazidi Janice Gillispie Mazidi Rolin D. McKinlay	Printice Hall -Inc	Second, 2007
2	The 8051 Microcontroller Architecture, Programming and Applications	Kenneth J Ayala Dhananjay V Gadre	Cengage Learning	2010

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	8051 Hardware Description	Datasheet	Intel Corporation	1992
2	Microprocessors and Microcontrollers	Lyla B. Das	Pearson Education	2011
3	ARM System-on-Chip Architecture	Steve Furber	Addison-Wesley Educational Publishers Inc	2000
4	System-on-Chip Design with Arm(R) Cortex(R)-M Processors	Joseph Yiu	ARM Education Media	2019

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	Microprocessors and Microcontrollers - https://nptel.ac.in/courses/106108100
2	Microcontrollers and Applications - https://nptel.ac.in/courses/117104072
3	Embedded System Design With ARM - https://onlinecourses.nptel.ac.in/noc22_cs93

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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.

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.

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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.

5. **Record (5 Marks)**

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

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