SEMESTER S5
MICROCONTROLLER

Course Code	**PBICT504**	**CIE Marks**	60
Teaching Hours/Week (L: T:P: R)	3:0:0:1	**ESE Marks**	40
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Understand Microcontroller Fundamentals and Architectures
2. Develop Proficiency in Programming Microcontrollers
3. Master Interfacing and Advanced Applications using microcontrollers

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	**Intel 8051 Microcontroller – Overview-Architecture- Instruction set - Addressing modes** Evolution of microprocessors and microcontrollers- Overview of Intel 8051 family of microcontroller - Architecture of Intel 8051 - ALU, internal RAM and ROM, Oscillator and Reset Circuits, Stack and stack pointer - Special Function Registers of 8051 - Ports - Instruction set of 8051 - Data transfer instructions, Arithmetic, Logical, Compare and Rotate instructions, Bit processing instructions - Addressing modes of 8051	**10**
2	**Microcontroller languages - ports - timers** Comparison of machine language, assembly language and high-level languages - Assembler directives and C data types for 8051 - An introduction to programming 8051 in Assembly and C language programming of 8051 - Examples illustrating the use of basic types of instructions - Programming the ports of 8051 - Timers of 8051 - Modes of operations - Programming the timers in assembly language and C language	**10**

3	**Serial communication and Interrupts** Introduction to serial communication - Synchronous and asynchronous communication – RS 232 – MAX232 - Modes of operations - Serial communication programming in assembly language and C language - Introduction to interrupts in 8051 - Priority of interrupts - Interrupt handling and execution for timer - External and serial interrupts - Programming to handle all types of interrupts in assembly language and C language. **8051 Microcontroller Interfacing** Interfacing external memory to Intel 8051 - Examples of Interfacing data memory and code Memory - Interfacing LCD to 8051 - Interfacing matrix keyboard Interfacing - ADC and DAC interfacing - Interfacing sensors - Interfacing relays, stepper motors and DC motors.	**13**
4	Overview of AVR family - RISC and Harvard architecture of the AVR – salient features - The general-purpose registers in the AVR – AVR data memory – Using instruction with data memory – AVR status register – Data RAM / ROM memory space allocation in AVR – AVR data format and directives - I/O ports – Counters and Timers – Interrupts – Serial ports - (no programming in AVR) Atmega 32 microcontroller block diagram Arduino – Block diagram description of the system– Programming Arduino- Examples of practical solutions using Arduino	**10**

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Suggestion on Project Topics

Course Assessment Method
(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Ex-1	Internal Ex-2	Total
5	30	12.5	12.5	60

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 2 marks **(8x2 =16 marks)**	• 2 questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub divisions. • Each question carries 6 marks. **(4x6 = 24 marks)**	**40**

Course Outcomes (COs)

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

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	demonstrate a comprehensive understanding of the Intel 8051 microcontroller family, including its architecture, instruction set, and various addressing modes.	**K2**
CO2	Demonstrate the skills to effectively program the Intel 8051 microcontroller using both assembly and C languages in ports and timers of 8051.	**K2**
CO3	Program 8051 serial communication and interrupt using assembly and C languages and also gain knowledge in Interfacing of memory, LCD, matrix keyboard, stepper motor, DC motor, ADC, DAC, sensors, and relays to 8051 microcontrollers.	**K3**
CO4	Explain the architecture of AVR and Arduino ATmega 32 microcontrollers and its features.	**K2**
CO5	Design and implement a microcontroller-based project in instrumentation and control engineering area and prepare a brief report.	**K3**

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

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CO-PO Mapping Table:

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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	The 8051 Microcontrollers & Embedded Systems	Muhammed Ali Mazidi and Janice GillispieMazidi	Pearson Education India	2nd edition, 2007
2	The 8051 Microcontroller Based Embedded Systems	Manish K Patel	McGraw Hill Education	1st edition, 2017
3	AVR Microcontroller and Embedded Systems: Using Assembly and C,	Muhammad Ali Mazidi, ZarmadNaimi	Pearson Education India	1st edition, 2013
4	Arduino: A Technical Reference	J. M. Hughes	O′Reilly	1st edition, 2016
5	The 8051 Microcontrollers & Embedded Systems	Muhammed Ali Mazidi and Janice GillispieMazidi	Pearson Education India	2nd edition, 2007
6	The 8051 Microcontroller Based Embedded Systems	Manish K Patel	McGraw Hill Education	1st edition, 2017

Reference Books				
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1	The 8051 Microcontroller	Kenneth Ayala	Delmar Cengage Learning	3rd edition, 2004
2	Microcontrollers: Architecture, Programming, Interfacing and System Design	Raj Kamal	Pearson	2nd edition 2011

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Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/108/105/108105102/
2	https://nptel.ac.in/courses/117104072

PBL Course Elements

L: Lecture (3 Hrs.)	**R: Project (1 Hr.), 2 Faculty Members**		
	Tutorial	**Practical**	**Presentation**
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation/ Video Presentation: Students present their results in a 2 to 5 minutes video

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Assessment and Evaluation for Project Activity

Sl. No	**Evaluation for**	**Allotted Marks**
1	Project Planning and Proposal	5
2	Contribution in Progress Presentations and Question Answer Sessions	4
3	Involvement in the project work and Team Work	3
4	Execution and Implementation	10
5	Final Presentations	5
6	Project Quality, Innovation and Creativity	3
Total		**30**

1. **Project Planning and Proposal (5 Marks)**
    - Clarity and feasibility of the project plan
    - Research and background understanding
    - Defined objectives and methodology

2. **Contribution in Progress Presentation and Question Answer Sessions (4 Marks)**
    - Individual contribution to the presentation
    - Effectiveness in answering questions and handling feedback

3. **Involvement in the Project Work and Team Work (3 Marks)**
    - Active participation and individual contribution
    - Teamwork and collaboration

4. **Execution and Implementation (10 Marks)**
    - Adherence to the project timeline and milestones
    - Application of theoretical knowledge and problem-solving
    - Final Result

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5. **Final Presentation (5 Marks)**
    - Quality and clarity of the overall presentation
    - Individual contribution to the presentation
    - Effectiveness in answering questions

6. **Project Quality, Innovation, and Creativity (3 Marks)**
    - Overall quality and technical excellence of the project
    - Innovation and originality in the project
    - Creativity in solutions and approaches