Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EXC501	Microcontrollers and Applications	04	--	--	04	--	--	04

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of Test 1 and Test 2					
EXC501	Microcontrollers and Applications	20	20	20	80	--	--	--	100

Course Pre-requisite:
- EXC303: Digital Circuits and Design
- EXC402: Discrete Electronic Circuits
- EXC403: Microprocessor and Peripherals

Course Objectives:
1. Learner shall study Architecture of microcontroller like intel8051 and ARM and its usages.
2. Learner shall also develop interpretation, analysis and design skill using microcontrollers and various peripherals.
3. At the end of course learner should be capable to design and develop a simple microcontroller based application.

Course Outcomes:
The student should be able to:
1. Explain basic terminology and describe the components, parts and operation of a microcontroller based system.
2. Describe the microcontroller architecture and usages of the instruction set of the representative microcontrollers.
3. Explain and perform input/output and interrupt operations in a microcontroller system.
4. Interpret and write simple programs for microcontroller applications.

Module No.	Unit No.	Topics	Hrs.
1		**8051 Microcontroller Architecture**	**6**
	1.1	8051 architectural features and its purpose, advantages	
2		**8051 Microcontroller Assembly Language Programming**	**12**
	2.1	Bit, byte, word processing, format conversion between HEX, BCD, ASCII	
	2.2	Data movement / copy operations, Block transfer of data, data swap / exchange	
	2.3	Arithmetic, logical, and stack operation, loops, condition evaluation, decision making based on flags	
	2.4	Call, return, jumps, serial and parallel port handling, timer / counter handling, interrupts and its handling	
3		**8051 Microcontroller Hardware and Software Applications**	**10**
		Objectives: Interpreting logical, electrical, timing specification, requirement of following interfaces and interfacing and accessing/controlling using assembly programs	
	3.1	External memory interfacing and memory access cycles, polled I/O, Interrupt I/O	
	3.2	**Serial communication using RS232**: Pulse width modulation and DC motor interfacing, electromagnetic relay, stepper motor interfacing, switch interfacing, SCR firing circuit (with electrical isolation)	
	3.3	**Parallel input/output interfacing**: 7-segment LED display interfacing, 8-bit parallel DAC interfacing, 8-bit parallel ADC interfacing, 4x4 matrix keyboard interfacing, temperature (resistive, diode based) sensor, optical (photodiode/ phototransistor, LDR) sensors interfacing, 16x2 generic alphanumeric LCD interfacing	
4		**ARM7TDMI(ARMv4T) Architectural**	**10**
	4.1	Features, purpose, and advantages	
	4.2	Processor operating states, memory formats, data types, operating modes, registers	
	4.3	The program status registers, exceptions, interrupt latencies, and pipelined architecture advantage	
5		**ARM7TDMI(ARMv4T) Assembly Language Programming**	**10**
	5.1	8,16,32 bit and floating point numbers processing, format conversion between Hex, BCD, ASCII, data movement/copy operations, block transfer of data, data swap/exchange	
	5.2	Arithmetic, logical, and stack operation, loops, condition evaluation and decision making based on flags, control transfers (Call, Return, Jumps), processor state changing (ARM $\leftrightarrow$ THUMB)	
	5.3	Exceptions, interrupts and its handling	
6		**LPC2148 based C Program Applications**	**4**
	6.1	Applications for On-chip ADC, DAC, parallel port, and serial port accessing	
		Total	**52**

Reference Books:

1. Kenneth J. Ayala, "*The 8051 Microcontroller architecture, Programming and Applications*" Penram international, Cengage Learning India Pvt. Ltd, (Patparganj), New Delhi.
2. M. A. Mazadi and J. C. Mazadi, "*The 8051 Microcontroller and Embedded Systems*", Pearson Education, Asia
3. V. Udayashankara, "*8051 Microcontroller Hardware, Software and Application*", McGraw-Hill.
4. David Seal, "*ARM Architecture*", Reference Manual (2nd Edition)
5. William Hohl, "*ARM Assembly Language: Fundamentals and Techniques*"

Internal Assessment (IA):
Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks

End Semester Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total 4 questions need to be solved.
3: Question No.1 will be compulsory and based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining questions will be selected from all the modules.

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