ITE3002	Embedded Systems	L	T	P	J	C
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Pre-requisite	**ITE2001**	**Syllabus version**				
		1.1				

Course Objectives:

- To learn the fundamentals of embedded systems and understand the programs and tools.
- To impart the knowledge about real time embedded systems.
- To elucidate the knowledge of embedded system types and its interfacing mechanisms.

Expected Course Outcome:

1) Understand the basic concepts of embedded systems and recognize the categories.
2) Comprehend the hardware and software architecture of the embedded system and its programming aspects using assembly Languages) and testing tools.
3) Understand the key concepts like interaction with peripheral devices.
4) Design real time embedded systems using the concepts of RTOS.
5) Understand the RTOS and its use in Portable Handheld Devices
6) Explore the emerging technologies of embedded systems.
7) Elaborate the concept of embedded system and its applications.

Student Learning Outcomes (SLO):	**2, 4, 17**
[2]	Having a clear understanding of the subject related concepts and of contemporary issues.
[4]	Having Sense-Making Skills of creating unique insights in what is being seen or observed (Higher level thinking skills which cannot be codified)
[17]	Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice

Module:1	**Introduction to Embedded Systems**	**6 hours**

Application Areas- Categories of Embedded Systems-Overview of Embedded System Architecture- Specialties of Embedded Systems-Recent trends in Embedded Systems.

Module:2	**Architecture of Embedded Systems**	**6 hours**

Hardware Architecture-Software Architecture-Development / Testing Tools.

Module:3	**Communication Interfaces**	**7 hours**

Need for Communication Interfaces-RS232/UART- USB-IEEE 1394 Fire wire-Ethernet-IEEE 802.11- Bluetooth.

Module:4	**Embedded / RTOS Concepts**	**7 hours**

Architecture of Kernel- Tasks and task Schedulers-Interrupt service Routines-Semaphores-Mutex-

Mail Boxes-Message Queues-Event registers-Timers-Memory Management-Priority Inversion Problem.		
Module:5	**Overview of Embedded / ROT System**	**7 hours**
Embedded OS-RTOS-Handheld Oss-Representative embedded Systems.		
Module:6	**Future Trends**	**5 hours**
Emerging Technologies- Pervasive / Ubiquitous.		
Module:7	**Security of Embedded systems**	**5 hours**
Embedding Intelligence- Emerging Applications.		
Module:8	**Contemporary issues:**	**2 hours**
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Dr. K V K K Prasad, Embedded / Real-Time Systems: Concepts, Design And Programming, Black Book, DreamTech Press, 2016.
Reference Books	
1.	Wayner Wolf, Computers as components – Principles of embedded computing system design, Morgan Kaufman, 2016
2.	Arnold S Berger, Embedded Systems Design: An Introduction to Processes, Tools &Techniques, CMP books, 2010.
3.	Vahid F., Givargies T., Embedded Systems Design, Third Edition, John Wiley & Sons, paperback-2011.
4.	Muhammad Ali Mazidi., Janice GillispieMazidi., The 8051 Microcontroller and Embedded Systems, Pearson Education Asia, 2012.
List of Challenging Experiments (Indicative)	
1.	Generate and store the following series up to 'N' terms: Value of 'N' is available in location 30H. The series is presented using decimal number system. 1, 2,3,11,12,13,21,22,23,31... up to N terms.
2.	A few random unsigned integers are stored from the internal data memory location 31H onwards. Number of terms (N) is available in location 30H. Assuming that none of these numbers is greater than 5, find the factorials of these integers and then find their sum. Assume that the sum would not exceed 8-bit value.
3.	Create a new array by removing only those integers that are perfectly divisible by 4 from an array, starting from 31H. Location 30H contains number of terms of this array. The new array is to be created from the location 60H. At return, the accumulator should indicate number of terms found. Original locations with digits divisible by 4 should be replaced by null.
4.	Write a subroutine to find the sum of the following series up to N terms. N is stored in

	location 30H. At return, the sum should be available in the accumulator. Assume that the value of N would not be more than 5. (Term)=n^3-$(n-1)^2$ Sum= (1^3-0^2)+(2^3-1^2)+(3^3-2^2)+ up to N terms.
5.	Some random hexadecimal numbers are stored from location 31H onwards. The number of terms (N) of the array is available in the location 30H. Convert all numbers to their corresponding BCD forms and store in their original locations. Assume no stored number is more than 63H.
6.	Develop a subroutine to update the display of a clock that can be called at every minute. The clock should display hours and minutes in BCD format. After displaying 23.59, the display should be shown as 00.00. Assume that the hour count is stored at location 31H and the minute count in location 30H, both in packed BCD format.
7.	A 4-digit BCD display should be shifted left by one digit in order to accumulate a freshly entered BCD digit available in the accumulator. Develop a subroutine to accomplish this task, assuming that locations 31H and 30H contain the higher and lower order numbers, respectively, in packed BCD format.
8.	A portion of a written text is stored in the internal data memory location from 40H to 7FH so that it occupies 64 bytes. The text is in the form of ASCII and contains several words. ASCII character 'space' of code 20H separates any two words in the text. The text may or may not start with a space and may or may not end with a space. Multiple spaces are also possible in between the words and at the start and at the end. Develop a program to count the number of words within the text, and store this number in the accumulator.
9.	There are 25 prime numbers between 2 and 100. Find a method to generate these prime numbers.
10.	Find out another method of sorting, and compare its efficiency with the bubble sorting method.
11.	A random array of integers was generated and stored from location 31H onwards, storing its number of terms at location 30H. However, although the algorithm generally does not permit the repeat of any integer, to check this, develop a program ensuring that there is no repetition of any term. In case of repetition, the program should come out with CY flag as set; otherwise, CY flag should be cleared.
12.	Develop a program to generate prime numbers by the method of divisions.

		Total Laboratory Hours	30 hours
Recommended by Board of Studies	12-08-2017		
Approved by Academic Council	No. 47	Date	05-10-2017