GUJARAT TECHNOLOGICAL UNIVERSITY

INFORMATION TECHNOLOGY (23)
EMBEDDED SYSTEM AND PROGRAMMING
SUBJECT CODE: 2742304
M.E. 4TH SEMESTER

Type of course: Elective

Prerequisite:

1. Operating system
2. C Programming
3. Microprocessor basics

Rationale:

- To study the overview of Embedded System Architecture
- To understand about the design methodologies in hardware and software design
- Understanding Implementation of Embedded Systems from chip-bring up to application development.
- Understanding how Embedded Processors can be interfaced with Embedded Sensors and other similar interfaces.
- To understand the various functions of RTOS

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction to Embedded Systems:** Embedded Systems, Processor Embedded Into A System, Embedded Hardware Units And Devices In A System, Embedded Software In A System And An Overview Of Programming Languages, Introduction To Embedded –System Design, Introduction To Embedded –System Architecture, Introduction To Embedded –System Model, Classification Of Embedded Systems, Examples Of The Embedded Systems	06	15%
2	**Embedded Systems Design and Development Process:** Embedded System-On-Ship (Soc) And Use Of VLSI Circuit Design Technology, Complex Systems Design And Processors, Build Process For Embedded Systems, Design Process In Embedded Systems, Design Challenges In Embedded Systems Optimising The Design Metrics, Challenges And Issues Related To Embedded Software Development, Hardware And Software Co-Design In An Embedded System, Embedded	**08**	20%

	Systems Design Technologies, Formalism Of System Design, Design Process And Design Examples		
3	**Hardware Platforms** Types Of Hardware Platforms, 89C51 Micro-Controller, Development Board, AVR Micro-Controller Development Board **Communication Interfaces** Need For Communication Interfaces, RS232/UART, RS422/RS485, US, Infrared, IEEE 1394 Firewire	**06**	15%
4	**8051, AVR, And ARM Microcontrollers, Real-World Interfacing, And The Inputs And Outputs Using Buses:** Introduction To Microcontrollers And Microprocessors, Embedded Versus External Memory Devices, Examples Of A Microcontroller-8051 Architecture, ATMEL AVR Microcontrollers, ARM Microcontrollers, Computer-System Buses, Real-World Interfacing, I/O Performance, I/O Buses, Network Oriented Bus Arbitration, Buses, Multilevel Buses	**06**	15%
5	**Programming Concepts And Embedded Programming In C, C++ And Java:** Programming In Assembly Language(ALP) And In High-Level Language 'C', 'C' Program Elements: Header And Sources Files And Pre-Processor Directives, Program Elements: Macros And Functions, Function Pointers And Function Queues, Queuing Of Functions On Interrupts And Interrupts-Service-Routines Queues, Embedded C And C++ : Overview Of Additional Features, Embedded Programming In C++, Optimisation Of Codes And Memory Needs In Embedded C++ Programs To Eliminate The Disadvantages, Embedded Programming In Java	**08**	20%
6	**Real Time Operating Systems II: Basic Functions Of OS And RTOS:** Operating System Services, Process Management, Timer Functions, Event Functions, Interrupt Routines In RTOS Environment And Handling Of Interrupt-Source Calls, **Introduction To Real-Time Operating Systems** Basic Design Using A Real Time Operating Systems, RTOS Task-Scheduling Models, OS Security Issues, OS Standards: POSIX, RTOS Interrupt Latency And Responses Times Of The Tasks As Performance Metrics, OS Performance Guidelines,	**08**	15%

Reference Books:

1. Embedded Systems: Architecture, Programming & Design by Raj Kamal McGRAW Hill Publication
2. Karim Yaghmour,"Building Embedded Linux Systems", 1/E, O'Reilly Media,2003.
3. Michael Barr, "Programming Embedded Systems in C and C++", O'Reilly Media, 1999.
4. Embedded / Real Time Systems: Concepts, Design & Programming (Black Book)
5. Frank Vahid, Tony Givargis, "Embeded System Design: A Unified Hardware / Software Introduction" 3/E Wiley India
6. M.A. Mazidi, J.G. Mazidi & R.D. McKinlay " The 8051 Microcontroller and Embedded Systems : Using Assembly and C" 2/E Pearson Education
7. D. Gajski, F. Vahid, S.Narayan, and J. Gong, "Specification and Design of Embedded Systems", 1/E, Prentice Hall, 1994.

Course Outcome:
After learning the course the students should be able to:

1. Know the background of and modern software engineering methods and techniques for embedded systems
2. Explain various embedded system applications and design requirements
3. Construct embedded system hardware
4. Develop software programs to control embedded system
5. Distinguish a real-time system from other systems
6. Evaluate the need for real-time operating system

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.