



Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous Institute Affiliated to University of Mumbai)

Course Code	Course Name	Teaching Scheme (Hrs/week)			Credits Assigned			
		L	T	P	L	T	P	Total
CPE8032	Elective-III Embedded Systems	4	-	--	4	-	--	4
		Examination Scheme						
		ISE		MSE		ESE		
		10		30		100 (60% Weightage)		

Pre-requisite Course Codes		-
At end of successful completion of this course, student will be able to		
Course Outcomes	CO1	Describe the special requirements that are imposed on embedded systems.
	CO2	Describe the key properties of microprocessor and digital signal processor.
	CO3	Sketch a design of an embedded system around a microprocessor or DSP.
	CO4	Explain how microprocessor, memory, peripheral components and buses interact in an embedded system.
	CO5	Evaluate how architectural and implementation decisions influence performance and power dissipation

Module No.	Unit No.	Topics	Ref.	Hrs.
1	1.1	Introduction to computational technologies	1,2	08
	1.2	Review of computation technologies (ARM, RISC, CISC, PLD, SOC), architecture, event managers hardware multipliers, pipelining.	1,2	
	1.3	Hardware/Software co-design. Embedded systems architecture and design process.	1,2	
2	2.1	Program Design and Analysis	1,3	08
	2.2	Integrated Development Environment (IDE), assembler, linking and loading. Program-level performance analysis and optimization, energy and power analysis and program size optimization, program validation and testing.	1,3	
	2.3	Embedded Linux, kernel architecture, GNU cross platform tool chain. Programming with Linux environment	1,3	
3	3.1	Process Models and Product development life cycle management	3,5	08
	3.2	State machine models: finite-state machines (FSM), finite-state machines, with data-path model (FSMD), hierarchical/concurrent state machine model (HCFSM),	3,5	



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	3.3	program-state machine model (PSM), concurrent, process model. Unified Modeling Language (UML), applications of UML in embedded systems. IP-cores, design process model. Hardware software co-design, embedded product development life cycle management.	3,5	
4	4.1	High Performance 32-bit RISC Architecture	3,6	08
	4.2	ARM processor family, ARM architecture, instruction set, addressing modes, operating modes,	3,6	
	4.3	interrupt structure, and internal peripherals. ARM coprocessors, ARM Cortex-M3.	3,6	
5	5.1	Processes and Operating Systems	8,10	08
	5.2	Introduction to Embedded Operating System, multiple tasks and multiple processes. Multi rate systems, preemptive real-time operating systems,	8,10	
	5.3	Operating system performance and optimization strategies. Examples of real-time operating systems.	8,10	
6	6.1	Real-time Digital Signal Processing (DSP)		08
	6.2	Introduction to Real-time simulation, numerical solution of the mathematical		
	6.3	Convolution, DFT, FIR filter and IIR Filter implementation on ARM. Open Multimedia Applications Platform (OMAP).		
			Total	48

References:

- [1] Embedded Systems an Integrated Approach – Lyla B Das, Pearson.
- [2] Computers as Components – Marilyn Wolf, Third Edition Elsevier.
- [3] Embedded Systems Design: A Unified Hardware/Software Introduction – Frank Vahid and Tony Givargis, John Wiley & Sons.
- [4] An Embedded Software Primer – David E. Simon – Pearson Education South Asia.
- [5] ARM System Developer's Guide Designing and Optimizing System Software – Andrew N. Sloss, Dominic Sysmes and Chris Wright – Elsevier Inc.
- [6] Embedded Systems, Architecture, Programming and Design – Raj Kamal – Tata McGraw Hill.
- [7] Embedded Linux – Hollabaugh, Pearson Education.
- [8] Embedded Realtime Systems Programming – Sriram V Iyer, Pankaj Gupta – Tata McGraw Hill.
- [9] Fundamentals of Microcontrollers and Applications in Embedded Systems – Ramesh Gaonkar – Penram International Publishing (India) Pvt. Ltd.
- [10] Embedded / Real-Time Systems: Concepts, Design & Programming – Dr. K. V. K. K. Prasad – Dreamtech Press, India.