

GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme	:	Diploma in ET/CE/EE//ME/MT/CM/IT/DDGM
Programme Code	:	01/02/03/04/05/06/07/08/16/17/21/22/23/24/26
Name of Course	:	Embedded Systems
Course Code	:	ET586

Teaching Scheme:

	Hours /Week	Total Hours
Theory	04	64
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests, each of 60 minutes	3 Hrs.	--	3 Hrs. For batch of 20 students	--
Marks	20	80	--	25	25

Course Rationale:

The study of embedded systems is essential. It deals with hardware with software embedded in it. This subject will enable student to develop logical thinking and use of "Firmware". This subject mainly deals with ARM-7 microcontroller, Students will be able to develop Real Time Systems, Device drivers, use interrupt service mechanism, program timing and counting devices and develop embedded C-Programs for Microcontroller.

Course Objectives:

After studying this course, the student will be able to

•	Access embedded systems hardware units like processor, I/O device, On-chip and Offchip device, Power supply etc
•	Write embedded program
•	Knowledge of developing microcontroller based systems.
•	Knowledge of communication protocols
•	Perform software analysis, design, implementation, testing, debugging for embedded systems..

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Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Marks
SECTION-I			
1.	Introduction ARM controller		
	1.1 RISC design philosophy ,ARM design philosophy, 1.2 Embedded System Hardware: arm bus technology ,arm bus protocol 1.3 Pipelining In Arm 1.4 ARM7 processor family 1.4 Simplified view – ARM7TDMI block diagram, core diagram , Thumb Mode concept 1.5 ARM7TDMI programming model – Registers, Operation modes, Exceptions and Interrupts, Reset Sequence , 1.6 On chip peripherals: - Internal memory, GPIOs, Timers, ADC, UART ,SPI,I2C, PWM, RTC,WDT (check for pins, block diagram, working of peripheral)	12	16
2.	ARM 7 Instruction set and Programming		
	2.1 Instruction Set, datatransfer,arithmetic,logical,comparison,multiply,loadstore,branching 2.2 simple programs depending on above instruction set expected .Can go for assembly or ‘C’ programs . 2.3 Simple programs of led blinking for GPIO (no programming for other on-chip peripherals in theory but can be done in lab)	10	12
3.	Communication Protocols		
	Study of communication of protocols with their features , OSI layer diagram and working 5.1 Serial protocols: USB, IEEE 1394 5.2 Network protocols: LIN,MODBUS, Ethernet 5.3 wireless protocols: IrDA, Bluetooth 5.4 Buses for Parallel Communication – ISA,PCI,PCI-X	12	12

SECTION-II

4.	Overview of Embedded Software		
	4.1 Categories of embedded systems , 4.2 Requirements of embedded systems, and Applications of embedded Systems. 4.3 Hardware architectures for embedded systems. 4.4 System on chip (SOC) 4.5 Survey of software architecture 4.6 Embedded software tools. IDE, Compiler, Debugger, Simulator, Emulator, In circuit Emulator(ICE), TargetBoard, Device Programmer 4.7 Embedded software development CYCLE.	12	12
5.	Device Driver & Interrupts Servicing Mechanism		
	5.1 ISR concept 5.2 Intruppt sources 5.3 Intruppt handling mechanism 5.4 Multiple intruppts, context switching 5.5 Device Drivers 5.6 Parallel port device driver 5.6 Serial port device driver 5.7 Internal Programmable timing devices .	10	12
6.	RTOS & Inter process Communication		
	6.1 Concepts of RTOS -Requirement, Need and Specification of RTOS in embedded systems. 6.2 Inter process Communication- Shared Resources, TaskMultitasking , Task synchronization , Context Switching, Kernels, Pre-emptive and non pre-emptive Schedulers, Static and Dynamic Priorities, Priority Inversion, Mutual Exclusion ,Starvation, Deadlock, Multiple process , Synchronization , Problem of sharing data by Multiple task and routines , 6.3 Inter task communication mechanisms: semaphores, Mailbox, Pipes.	10	16
	TOTAL	64	80

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List of Practical/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
1.	Identification & observation of ARM7 system board on the kit.	02
2.	Introduction of KEIL /IAR/ any IDE software .	02
3.	Assembly language or C programs which cover data moving instruction ,block transfer ,Arithmetic instructions, Jump, instructions, Logic instructions, comparison,multiply,load store.	14
4.	Generate square wave and rectangular wave on port pin with a program	02
5.	External interfacing of leds with ARM	02
6.	Blink LEDs in a controlled pattern	02
8.	Control an LED using a switch by interrupt method.	02
9.	Take analog readings on rotation of rotary potentiometer connected to an ADC channel	02
10.	Display message on LCD	02
11.	UART communication.	02
	Total	32

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction ARM controller	Class room teaching & Laboratory work
2.	ARM 7 Instruction set and Programming	Class room teaching & Laboratory work
3.	Communication Protocols	Class room teaching & Laboratory work
4.	Overview of Embedded Software	Class room teaching & Laboratory work
5.	Device Driver & Interrupts Servicing Mechanism	Classroom Teaching
6.	RTOS & Inter process Communication.	Classroom Teaching & Lab. Work

Text Books:

Sr. No	Author	Title	Publication
1.	Sloss Andrew N, Symes Dominic, Wright Chris,	ARM System Developer's Guide: Designing and Optimizing system software	Pearson
2.	ARM7TDMI Microcontroller datasheet and User Manual	---	Morgan Kaufman Publication
3.	Raj Kamal	Embedded Systems – Architecture: Programming and Design	TMH

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Reference Books:

Sr. No	Author	Title	Publication
1.	Steve furber	ARM System-on-Chip Architecture	Pearson Education.
2.	Frank Vahid and Tony Givargis	Embedded System Design	Wiley




Technical references and user manuals on www.arm.com and Texas Instruments www.ti.com

Learning Resources: Reference Books, Journals, Data Manuals, and URL's.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
Section I					
1.	Introduction ARM controller	8	4	4	16
2.	ARM 7 Instruction set and Programming	4	4	4	12
3.	Communication Protocols	4	4	4	12
4.	Overview of Embedded Software	8	4	-	12
5.	Device Driver & Interrupts Servicing Mechanism	4	4	4	12
6.	RTOS & Inter process Communication.	4	8	4	16
Total		32	28	20	80

Prepared By :

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