Estd. 1962
NAAC 'A' Grade

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दुरध्वनी (ईपीएबीएक्स) २६०९००० (अभ्यास मंडळे विभाग– २६०९०९४)
फॅक्स : ००९१-०२३१-२६९१५३३ व २६९२३३३.e-mail:bos@unishivaji.ac.in

SU/BOS/Science/No 0 0 3 9 6 **Date: 1 8 OCT 2021**

To,

The Principal,
All Affiliated Concerned Science Colleges/Institutions
Shivaji University, Kolhapur.

Subject: Regarding New syllabi of **M.Sc. Part- I Embedded Technology CBCS** degree programme under the Faculty of Science and Technology

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the New syllabi, Nature of question paper of **M.Sc. Part- I Embedded Technology CBCS CBCS** under the Faculty of Science and Technology.

This syllabi, nature of question paper shall be implemented from the academic year 2021-2022 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in (students Online Syllabus)

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

Shivaji University, Kolhapur

SYLLABUS

M.Sc. Embedded Technology

Choice Based Credit System (CBCS)

Semester- I & II

(W.e.f June, 2021)

M.Sc. Embedded Technology

1. **Title of the Course:** M.Sc. Embedded Technology

2. **Introduction:**

M.Sc. Embedded Technology,an innovative programme,is introduced in **Smt. Kasturbai Walchand College of Arts and Science Sangli** from June 2021 and opened the doors of ubiquitous technology knowledge. It is also proposed to disseminate knowledge of the subject from fundamental concepts to State-of- Art technologies. Indeed, it helps to keep pace with global requirements. With the view to provide exposure to the recent technologies of various sectors of the Electronics and to empower the students to make them competent for industrial needs, R & D sectors and self-employment the curriculum is framed. Indeed, the curriculum encompasses knowledge of Embedded System and Instrumentation, Analog and Mixed signal Based SoC design, Wireless Sensor Network, Internet of Things and VLSI design and technologies. Therefore, the students may have better job opportunities. The course is of interdisciplinary relevance. Incorporation of practical examples and case studies to take students on a journey from microcontroller and AMS devices through to real-world applications of technology. The course helps to build your own technical skills in embedded systems, the IoT and AI, as well as enable you to bring this to life. The Choice Based Credit System (CBCS) is implemented for this course.

3. Objectives of the course:

Following are major objectives of the course.

- To provide exposure to the students to the recent technologies.
- To provide the knowledge of design and implementation of embedded systems for dedicated applications.
- To inculcate awareness among the student to perform the projects of industrial standards, which could also, ensures the interdisciplinary approach.
- To empower the students to cater the needs of industrial sectors. It is also attempted to expose the students to the research activities and to inculcate the research awareness.

- To expose the students to the industrial environment, on job training and internship may be provided
- To expose the students to the facets of real time systems

4) Advantages of the Course:

M.Sc. Embedded Technology is the subject, which ensures wide application potential in diverse sectors. Along with the basic sciences, it bears the knowledge of recent technologies. Therefore, it depicts the tremendous opportunities in the electronic industrial sectors. It ensures well confluence of Science and Technology. Therefore, the course helps to achieve all round development. Moreover, the students can also opt for education field for their career.

5) Eligibility :

- B. Sc. with Electronics subject at Principal / Interdisciplinary /Allied/ Applied
- B. Sc. Electronics at Subsidiary level.
- B.Sc. with Computer Science/ B.Sc. Entire Computer Science(BCS)

6) Intake Capacity : 20

7) Duration: 2 Years – 4 Semesters

8) Fee Structure:

This is non-grantable course. Therefore, fee structure is as per Rules and Regulations of Shivaji University, Kolhapur

9) The Choice Based Credit System (CBCS):

Total Credit points : 96
Total Marks : 2400

Sr No.	Semester	Credits for Theory	Credits for Practical	Total Credits
1.	I	16	8	24
2.	II	16	8	24
3.	III	16	8	24
4.	IV	16	8	24
	Total	64	32	96

10) Structure of the Course:

The course structure for M. Sc. Embedded Technology

(CBCS :Choice Based Credit System)

CGPA/ Non-CGPA	Sr No.	Course Code	Title of the course	Teaching Scheme		
				Lectures per week	Hours Per weak	Credits
M.Sc.-I Semester -I						
CGPA	1.	CC101	Fundamentals of Embedded System Design	4	4	4
	2.	CC102	CMOS Analog Circuit Design	4	4	4
	3.	CC103	Advanced Digital Design with Verilog HDL	4	4	4
	4.	CC104	Advanced Microcontroller Based Embedded system Design	4	4	4
	5.	CCPR105	-	16	16	8
			Total			**24**
Non-CGPA	**1**	**AEC-101**		**2**	**2**	**2**
	2	**EC-101**	**NPTEL/SWAYAM course of Equivalent Lectures**			
M.Sc.-I Semester –II						
CGPA	**1**	CC201	Real Time Operating System	4	4	4
	2	CC202	Mixed Signal Based PSoC Design	4	4	4
	3	CC203	Embedded System Design with FPGA	4	4	4
	4	CC204	Device Drivers and Embedded System	4	4	4
	5	CCPR105	-	16	16	8
			Total			**24**
Non-CGPA	**1**	**AEC-201**		**2**	**2**	**2**
	2	**EC-201**	**NPTEL/SWAYAM course of Equivalent Lectures**			

- CC : Core Course
- CCPR: Core Course Practical
- AEC : Ability Enhancement Course (Mandatory Non-CGPA compulsory)
- SEC : Skill Enhancement Course (Mandatory Non-CGPA compulsory)
- CCS : Core Course Specialization
- DSE : Discipline Specific Elective
- EC : Elective Course (Non-CGPA (SWAYAM NPTEL))

The course structure for M.Sc. Embedded Technology

(CBCS : Choice Based Credit System)

M.Sc.-II Semester -III						
CGPA	1.	CC301		4	4	4
	2.	CC302	Wireless Sensor Network	4	4	4
	3.	CC303	Programming with Python	4	4	4
	4.	DSE304	ARM Microcontroller and Embedded System Design	4	4	4
	5.	DSE304		4	4	4
	6.	CCPR305	-	16	16	8
			Total			**24**
Non-CGPA	**1**	**AEC-301**		**2**	**2**	**2**
	2	**EC-301**	**NPTEL/SWAYAM course of Equivalent Lectures**			
M.Sc.-II Semester -IV						
CGPA	**1**	CC401		4	4	4
	2	CC402	Intelligent IoT System Design	4	4	4
	3	CC403	Smart Fusion Technology Based System Design	4	4	4
	4	DSE404		4	4	4
	5	DSE404	Artificial Intelligence & Machine Learning	4	4	4
	6	CCPR405	Project work	16	16	8
			Total			**24**
Non-CGPA	**1**	**AEC-401**		**2**	**2**	**2**
	2	**EC-401**	**NPTEL/SWAYAM course of Equivalent Lectures**			
			Total Credits			**96**

M.Sc. Embedded Technology
Course Code: CC-101: Fundamentals of Embedded System Design

Total Marks 100
(60 Periods)

Course Objectives :

1. To expose the students to facets of embedded system design.
2. To expose the students to advanced computing devices.
3. To make students competent to develop embedded firmware.
4. To develop the skills to design an embedded system for dedicated applications.

Course Outcomes :

1. Understand basic concept of an Embedded System.
2. Able to develop firmware in embedded C structure.
3. Understand architecture of AVR family microcontroller.
4. Able to configure on chip resources and to interface devices.
5. Able to develop embedded system for dedicated applications

Module 1: Fundamentals of Embedded Systems design (15)

Definition of an embedded system, Basic architecture of embedded system, characteristics of embedded systems, Challenges in Embedded System Design,real time consideration, need of processor, Applications of embedded systems. AVR microcontroller based minimum hardware for general embedded system.

Module 2: Programming with Embedded C: (15)

Overview of C programming, Basic Structure of C program, character set, keywords and identifiers, constants and variables, concept of global declaration and local declaration, data types and data ranges, expressions and operators. Study of IO statements, Control Statements, Arrays, Loops, User`s defined functions.

Embedded firmware, Basic Structure of Embedded C program, Comparison of Embedded C with C, Need of Operating System, Concept of Super loop. An embedded C programs for Generation of Time delay with and without use of timers, Square wave generation, Programming of I/O port and Serial Port, Interrupts.

Module 3: Interfacing of devices: The Hardware and Embedded Firmware Design (15)

Development of both Hardware and software for interfacing of Switches, Thumbwheel switch, Relays, LEDs, Transistor, Opto-coupler, Seven Segment Display, 16 X 2 LCD, Stepper Motor, Configuration of on-chip resources such as ADC, DAC, timers/counters etcof AVR ATmega 8L microcontroller. Designing of ISP, ICSP modules for programming and debugging

Module 4: Designing of an Embedded System (15)

1. Designing of AVR ATmega 8L an based embedded system for Measurement of Temperature of an environment
2. Designing of AVR ATmega 8L anbased embedded system for Measurement of humidity of an environment.
3. Designing of AVR ATmega 8L based embedded system for DAC using PWM technique.

Reference Books: -

1. Embedded C - Michael J Point
2. Embedded C Programming and the Atmel AVR, Richard H. Banett, Sarah A. Cox, Larry D. O'Cull, Thomson.
3. Programming and customizing The AVR Microcontroller, DhananjayGadre, TMH.

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M.Sc. Embedded Technology

Course Code: CC-102:CMOS Analog Circuit Design

Total Marks 100
(60 Periods)

Course Objectives :

1. To expose the students conduction mechanism in MOS device and its approach to analog circuit design..
2. To realize the use of MOS device for design of analog circuit components.
3. To study design of operational amplifier using MOS device
4. To expose the students to switched capacitor technique for analog design

Course Outcomes :

1. Understand conduction mechanism in MOS transistors and its use for analog circuit design.
2. Designing of design CMOS based analog circuits
3. Designing of CMOS based operational amplifier.
4. Able to design configurable analog circuits using switched capacitor techniques.

Module 1: Fundamentals CMOS Analog Design: 15

Biasing of n and p channel MOS transistors, Conduction mechanism in MOS device, Drain current relation, Effect of gate, drain and source potential, channel width modulation, Need of analog Integrated circuit design, Single Stage Amplifiers, CS amplifier, Large signal model, small signal model. BiCMOS.transistor.

Module 2: Analog CMOS circuit elements 15

MOS Switch and its characteristics, MOS Resistor, MOS Capacitors, MOS Diode, Current sink and current source circuits, Current mirrors, passive and active current mirrors. References for Analog MOS circuits, Voltage and Current reference, Band gap reference. CMOS Amplifier :CMOS amplifiers, frequency response of CMOS amplifier, Cascode amplifier, class A Amplifiers, Push-pull CS amplifier, differential amplifier.

Module 3:CMOS Operational Amplifiers 15

Design of CMOS OP Amps, Single stage Op amp, Block diagram of two stage Op amp, Op am design requirements, Concept of High performance CMOS op amp, CMOS open loop Comparator.

Module 4. Switched Capacitor circuits 15

Basic principle of switching capacitor, Resistor emulation, series capacitor and parallel capacitors, effect frequency and phase of clock, switch capacitor amplifiers, inverting, non-inverting, summing amplifiers, difference amplifier, Integrator, differentiator, Low pass filter.

ReferenceBooks:

1. CMOS Analog Circuit Design, P. E. Allen, D. R. Holberg, International students edition Oxford, 2009
2. CMOS Analog Circuit Design, P. E. Allen, D. R. Holberg, Indian students edition Oxford, 2013
3. Design of analog CMOS integrated circuits, B. Razavi, TMH, 2013
4. CMOS Circuit design layout and simulation, R. J. Baker, H. W. Li and D. E. Boyce, PHI, 2005

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M.Sc. Embedded Technology

Course Code: CC-103: Advanced Digital Design with Verilog HDL

Total Marks 100
(60 Periods)

Course Objectives :

1. To study structure of VHDL and Verilog HDL.
2. To expose the students to the syntax of Verilog HDL and digital design.
3. To understand use of Verilog HDL for embedded design.
4. To study configurability in digital design.

Course Outcomes :

1. To understand behavioral modeling and use of various statements and controls of Verilog design.
2. Writing firmware in Verilog HDL
3. To realize combinational and sequential circuit design using Verilog HDL.
4. Design of digital circuit for typical application.

Unit 1. Fundamentals of Verilog HDL **15**

Design flow, operators, data types, modules and ports. Gate-level modelling: gate types and gate delays, Dataflow modelling: Continuous assignments, delays, expressions, operands, operator types. Behavioral modelling: Structured procedures, Procedural assignments, Timing controls, conditional statements, Multiway branching, Loops, Seqential and parallel blocks, generate blocks, Tasks and functions

Unit 2. Combinational Logic Design **15**

Introduction to combinational circuits, NAND-NOR structures, comparator, code converters, multiplexers, demultiplexers, encoder and decoders, priority encoders, parity generator/checker,arithmetic circuits (full adder, full subtractor) 4-bit ripple adder, ALU (VERILOG models of above combinational circuits)

Unit 3. Sequential Logic Design **15**

Introduction to sequential circuits, Flip Flops (D, T and M-S JK) Counters: synchronous and asynchronous 4-bit counters, up/down counter, Registers: various types of registers, ring counter, Johnson counter Finite State Machine (FSM) Design: Mealy and Moore state machines. (VERILOG Models and Simulation of above Sequential Circuits)

Unit 4. Advanced Verilog issues **15**

Timing and delays: Types of delay models, Timing checks, Delay back-annotation, User defined primitives (Combination and sequential), Programming language interface: Linking and invocation, Internal data representation, PLI library routines. Verilog synthesis, Synthesis design flow

Reference Books:

1. Verilog HDL; A Guide to Digital Design and Synthesis by Samir Palnitkar, Pearson Education, 2nd edition, 2003.
2. Verilog HDL synthesis; A Practical Primer by J. Bhaskar, Star Galaxy Publishing, 1998.
3. Digital System Design with VERILOG Design by Stephen Brown, ZvonkoVranesic,TMH, 2nd Edn, 2007.
4. Advanced Digital Design with the Verilog HDL by M. D. Ciletti, PHI. 2009.

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M.Sc. Embedded Technology

Course Code: CC-104:Advanced Microcontroller Based Embedded system Design

Total Marks 100
(60 Periods)

Course Objectives :

1. To study Advanced Microcontroller, the PIC microcontroller Cores.
2. To expose the students architectural details of PIC microcontrollers.
3. To study integrated development environment for PIC based embedded firmware design.
4. To Develop an embedded system for dedicated applications.

Course Outcomes :

1. Students may realize configuration of on chip resources of PIC microcontroller.
2. Co-design of hardware and firmware for PIC based embedded system.
3. Interfacing different peripherals to PIC microcontrollers.
4. Design of PIC based autonomous embedded systems.

Module 1: PIC Microcontrollers **20**

Introduction: Advantages of PIC microcontrollers over MCS-51 series. PIC microcontroller features, Architecture of PIC microcontrollers, Pin Description, 16F8XX series. Architecture of 16F877. Memory structure, Resisters, Register file structure, Register banks, program and data memory, Use of EEPROM, SFRs, W-register, Status register, Option register etc. Interrupts in PIC microcontrollers, IO ports of 16F877.

Timers of PIC Microcontrollers, Compare capture mode, PWM mode, I2C bus , On Chip ADC and DAC facility. USART the serial IO, watchdog timer, Power up timer, Sleep mode, Reset, and clock circuits, types of the RESET. Interrupt vector table. Addressing modes, Instruction set architecture.

Module 2: Integrated Development Tools for PIC **10**

Overview of MPLAB the IDE for Assembly language.Micro C the IDE for embedded C programming. Developing, compiling, and programming the microcontroller.

Module 3 : Embedded C programmingand interfacing with PIC 15

Minimum Embedded system with PIC microcontroller, Serial programming, SPI programming. Embedded C programs for configuration of IO port, on chip timers and serial IO peripherals.Interfacing smart LCD, relay, opto-coupler, configuration of ADC& DAC etc.Designing of ISP, ICSP modules for programming and debugging

Module 4 :Development of PIC based an embedded system for **15**

i. Monitoring of environmental parameters
ii. Monitoring and controlling Industrial parameters

Reference Books:

1. PIC Microcontrollers and Embedded systems using Assembly and C for PIC18 – M.A. Mazidi, R. D. Mckinlay and D. Causey - Pearson Education, New Delhi- 2009.
2. Embedded design with PIC18F452, John B.Peatman
3. Embedded C programming and the Microchip PIC – Richard Barnet, L.O.Cull and S. Cox Delmer.-2004.

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M.Sc. Embedded Technology

Course Code: CC-201 : Real Time Operating System

Total Marks 100
(60 Periods)

Course Objectives :

1. To expose the students to basic concept of RTOS.
2. To study RTOS kernel and Kernel objects.
3. To study scheduling mechanism and concept of preemption.
4. To Develop real time embedded systems.

Course Outcomes :

1. Should get acquainted with basic concept of RTOS.
2. Should understand RTOS structure, RTOS kernel and task scheduling mechanism.
3. Writing embedded firmware in RTOS.
4. Design of real time based an embedded systems using advance microcontrollers.

Module1: Fundamentals of Real Time Operating System 20

a) **Introduction:** Concept of Real Time, Real Time operating System, Characteristics of Real-Time operation system, Hard and Soft Real Time Systems.
b) **Structure of RTOS:** Structure of RTOS, RTOS Kernel, Kernel Objects, Services of Scheduler.
c) **Task :** Task, Task structure, Creation of task, types of task, Task Control block, context, States of task and FSM, idle task, Priority, Static and dynamic priority, Resources, Sharing of resources, ISR, Task Management.
d) **Scheduling Algorithm :**Task scheduling Algorithm, preemption, FIFO, Round Robin scheduling, priority based preemptive scheduling. Priority Inversion, Software and hardware time Ticks, context switching.

Module:2Task Synchronization and Intertask communication 15

a) **Synchronization of task :** Concept of Sharing of resources, Race condition, Critical condition, deadlocks, spinlocks,
b) **Semaphores and mutexes :** Concept of semaphore, Binary semaphore, Counting semaphore, Semaphore management,
c) **Mutexes :**Concept of mutex, mutex management.
d) **Intertask communication:** Intertask Communication, Messages, Queues, Mailboxes.

Module:3The RTOS Kernel MicroC/OS-II 15

MicroC/OS-II kernel, creation of task, task management, Simple programs on creation of task.RTLinux Kernel, POSIX Pthreads, Processes and Threads, Thread Basics, Process management, semaphores, mutexes.Simple programs on creation of threads.Introduction to FreeRTOS.

Module 4 : RTOS Based Embedded System design using advanced microcontrollers 10

Simple programs based on Tiny RTOS, Vxworks/FreeRTOS for AVR microcontrollers, Design of real time embedded system for monitoring and control of environmental parameters. Design of real time embedded system for industrial parameters.

Reference Books:

1. Embedded C - Michael J Pont
2. Embedded C Programming and the Atmel AVR - R. H. Barnett, S. Cox and L. O'Cull
3. Real-Time Systems – C.M. Krishna and K.G. Shin
4. Embedded / Real Time Systems – Concepts design – programming- KVVK Prasad.
5. MicroC/OS-II, The Real Time Kernel, - J.J. Labrosse, 2nd Edn. (2006) CMP Books

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M.Sc. Embedded Technology

Course Code: CC-202 : Mixed Signal Based SoC Design

Total Marks 100

(60 Periods)

Course Objectives :

1. To study concept of Analog and Mixed Signal based PSoC.
2. To study architecture of PSoCs.
3. To study IDEs for design and development of PSoC.
4. To Develop PSoC based embedded systems for dedicated applications.

Course Outcomes :

1. Understanding of architecture of PSoC and configuration features of both on chip analog and digital resources.
2. Able to configure communication perpherals.
3. Writing firmware for PSoC based embedded design.
4. Design of mixed signal based SoC for dedicated applications.

Module :1 Mixed-signal embedded SoC architectures. 10

Concept of mixed signal design. Design Issues of Mixed Signal VLSI, Mixed-signal SoC ,architectures. Microcontroller M8C core. Instruction set. RAM and flash memory system. I/Os.System buses. Interrupt subsystem. Interrupt Service Routine (ISR). Boot program, Static & Dynamic reconfiguration.

Module :-2 Programmable Digital subsystem. 15

Performance improvement through architecture customization.Profiling.Performance profiling.PSoC programmable digital building blocks (timers, counters, CRC generator, PWM). Data communication in embedded systems.Serial communication using SPI and UART.

Module : 3 Continuous Time and Switched capacitor analog building blocks. 15

Basics of continuous time analog circuits.Presentation of basic building blocks, i.e., ideal op amps, comparators, PGA, Instrumentation amplifier, integrators, etc.

Basics of switched capacitor analog circuits.Presentation of basic building blocks, i.e., ideal op amps, comparators, gain, integrators, etc.Application of Switch-Capacitor circuits.

Module : 4 Delta-Sigma Analog to digital converters. 10

Basics of Delta-Sigma converters (DS).Sampling.Quantization.Oversampling.Noiseshaping.Performance of DS ADC. First-order DS ADC. Second-order DS ADC.Implementation using PSoC. Impact of circuit non-idealities on ADC performance.

Module : 5 Design of Mixed signal based system 10

Design of mixed signal based system for

a) Temperature, Humidity and CO2 measurement

b) Interfacing of PIR sensor

c) Touch sensing

Reference Books:

1. Introduction to Mixed signal, Embedded Design A. N. Doboli and E. H Currie Cypress semiconductor corporation (2007)
2. Designers Guide to the Cypress PSoC by Robert Ashby Elsevier
3. CMOS Circuit design, Layout and Simulation, R. J. Baker, WSE, Willey (2009)

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M.Sc. Embedded Technology

Course Code: CC-203 : Embedded System Design with FPGA

Total Marks 100

(60 Periods)

Course Objectives :

1. To study the architectures of FPGA devices
2. To study basic of CMOS design flow.
3. To study interfacing of the peripheral devices FPGA

Course Outcomes :

1. Ability of co-design of Hardware and software for embedded design with FPGA
2. Design and simulation of circuits with FPGA
3. Students should able to interface peripheral devices to the FPGA.

UNIT-I: Embedded System Overview

General Architecture of Embedded system design, Design Challenges and Design Life Cycle, Hardware, Software and FPGA platform. FPGA: Function Generators, Storage Elements, Logic Cells, Logic Blocks, I/O Blocks, Special-Purpose Function Blocks. Hardware Description Languages: VHDL, Verilog and Other High-Level HDLs, Configuration of Bit-stream. Types of ASICs, Design Flow, CMOS transistors, CMOS design rules, Combinational Logic Cell, Sequential logic cell, Data path, logic cell, Library cell design

UNIT-II: Floor planning, placement and routing

System partition - FPGA partitioning - partitioning methods,Overview of Partitioning Problem. Analytical Solution to Partitioning: Basic definitions, Expected performance gain, Resource considerations, Analytical Approach. Communication: Invocation/Coordination, Transfer of State. Practical Issues: Profiling Issues, Data Structures Manipulate Feature Size.floor planning, placement and routing , physical design flow, extraction - DRC.

UNIT-III: System Design using FPGA

Principles of system design: Design quality, Modules and interfaces, Abstraction and state, Cohesion and coupling, Control flow graph. Digital clock Managers, Clock management, Regional clocks, Block RAM, Distributed RAM, Configurable Logic Blocks, LUT based structures, Phase locked loops, Select I/O resources, Anti fuse, static RAM, EPROM and EEPROM technology Hardware Design: Platform FPGA Components, Adding to Platform FPGA Systems, Assembling Custom Compute Cores. Software Design: System Software Options, Root File system, Cross-Development Tools, Monitors and Bootloader.

UNIT-IV: FPGA Devices, Architecture and Interfacing

Device Architecture, Spartan 6, Vertex 4 architecture, Altera Cyclone and Quartus architectures. Verilog and VHDL logic synthesis,Interfacing of the peripherals to FPGA, Interfacing of ADC, DAC, Serial Data Communication, Physical Layer for Serial Communication: RS-232 and RS-485 based Communication. Serial Peripheral Interface (SPI), Signal Conditioning with FPGAs. Embedded System design with FPGA Case Studies.

REFERENCE BOOKS

1. M.J.S. SMITH, "Application Specific Integrated Circuits", Addison Wesley Longman Inc., 1997
2. Wolf Wayne, "FPGA Based System Design", Pearson Education.
3. Design manuals of Altera, Xilinx and Actel.
4. Embedded System Design with FPGA: Principles and Practices by Ron Sass and Andrew G. Schmidt.
5. Introduction to Embedded System Design Using Field Programmable Gate Arrays by Rahul Dubey.

M.Sc. Embedded Technology

Course Code: CC-204 :Device Drivers and Embedded System

Total Marks 100

(60 Periods)

Course Objectives :

1. To study the concept device driver for embedded design.
2. To study hardware and software for device programmer
3. To develop device drivers for embedded system.

Course Outcomes :

1. To understand the facets of device drivers.
2. Able to design hardware for device programmer.
3. Able to develop middle ware for device driver.

Module : 1 Fundamentals of Device Drivers for Embedded System. 15

Meaning and need of device drivers/programmers for embedded system development, Hardware for devices drivers in UART, SPI, I2C communications, Basic software architecture of device driver as middle ware, types of device drivers. Device driver architecture for 89S51 microcontroller based embedded system design. Boot programming and Application program.

Module :-2 Polling mode device drivers. 15

Basic concept, hardware design, embedded C program for device driver, communication with PC, communication with microcontroller, Baud rate setting, use of SFRs, buffer registers, setting and resetting of the flag bits, Programming the target device.

Module : 3 Interrupt driven device drivers. 15

Interrupt mode of data transfer, flags to check, accessing of the flags during data communication, handshaking of the signals, hard for device programmer, software for data communication in serial mode, SPI mode and I2C mode, Programming the target device.

Module : 4 Device driver designing 15

Design of device driver for AVR ATmega8L based embedded system design in SPI and I2C mode.

Design of device driver for PIC 18F877microcontroler based embedded system

Reference Books:

1. "Embedded Systems - Architecture, Programming and Design", Raj Kamal, Publs.: McGraw-Hill Education 2015.
2. Master Microcontroller and Embedded Driver Development, KiranNayak Embedded Brain Academy,2021
3. Linux Driver Development for Embedded Processors - Second Edition: Learn to develop Linux embedded drivers with kernel 4.9 LTS, Alberto Liberal de los Ríos, 2018

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M.Sc. Embedded Technology

In the beginning students will be exposed to

4. Design of minimum system with AVR ATmega 8L microcontroller
5. Design of minimum system with PIC microcontroller

Semester – I List of Experiments

Group – A : Fundamentals of Embedded System Design

1. Design and development of an Embedded system for interfacing of LCD to AVRATmega 8L microcontroller.
2. Design of Embedded C firmware for Configuration on chip ADC of AVR ATmega 8L and design of embedded system for analog voltage measurement.
3. Design of Embedded C firmware for Configuration on chip Timers for generation of delay.
4. Designing of AVR ATmega 8L an based embedded system for Measurement of Temperature of an environment
5. Designing of AVR ATmega 8L an based embedded system for Measurement of humidity of an environment

Group - B : CMOS Analog Circuit Design

1. Study of MOS Transistor as switch.
2. Design of current source and current sink circuit by using MOS Transistor
3. Design of differential amplifier by using MOS Transistor
4. Study of MOS device as a pn junction diode.
5. Study of Switched capacitor modeling MOS device for analog applications.

Group – C : Advanced Digital Design with Verilog HDL

1. Synthesis and simulation of Basic gates, Encoders and Decoders by using Verilog HDL
2. Synthesis and simulation of Multiplexure and Demultiplexure by using Verilog HDL
3. Synthesis and simulation of RS, D flip-flops and registers by using Verilog HDL
4. Design of BCD to 7 segment decoder and interfacing of 7 segment display and switches by using Verilog HDL

Group – D : Advanced Microcontroller Based Embedded system Design

1. Designing ISP for programming with PIC microcontroller.
2. Design and development of an Embedded system for interfacing of LCD to PIC microcontroller.
3. Design of Embedded C firmware for Configuration of ADC and chip Timers for generation of delay.
4. Designing of PIC based an embedded system for Measurement of typical environment parameters
5. Designing of PIC based an embedded system for Measurement of typical industrial parameters

Semester – II List of Experiments

Group – A : Real Time Operating System

1. Defining of the Tasks and Programming of the System in RTOS for Initialization of IO ports
2. Programming of the System in RTOS forInter task Communication .
3. Programming of the System in RTOS for interfacing of LCD Display.
4. Programming of the System in RTOS for Serial Communication.
5. Programming of the System in RTOS to study implementation of Semaphores

Group - B : Mixed Signal Based PSoC Design

1. Study of on-chip resources, Inverting amplifier, instrumentation amplifier, and clocking facilities of Cypress PSoC devices and their configurability.
2. Study of on-chip resources, ADC, DACand PWM of Cypress PSoC devices and their configurability.
3. Design of system on chip for interfacing of LCD to Cypress PSoC 5.
4. Design of system on chip for measurement of temperature of environment
5. Design of system on chip for measurement of humidity of environment

Group – C : Embedded System Design with FPGA

1. Study of Device Architecture of Spartan 6 and Verilog and VHDL logic synthesis
2. Interfacing of the ADC and DAC to FPGA.
3. Interfacing of the Switches and LCD to FPGA.
4. Study of Serial Data Communication with FPGA.
5. Development of an embedded system using FPGA for industrial applications

Group – D : Device Drivers and Embedded System

1. Design of circuit for In-System Programming for programming of microcontroller.
2. Development of middleware for Boot programming
3. Development of middleware for serial communication
4. Design of device driver for AVR ATmega8L based embedded system design in SPI
5. Design of device driver for PIC 18F877microcontroler based embedded system

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