SILVER OAK UNIVERSITY

College of Technology

Master of Technology

Electronics and Communication

Course Name: Real-time Fundamentals for Embedded Systems

Course Code: 1010097103

Semester: 2nd

Prerequisite: Introductory course on Embedded Systems, Microcontrollers (any), Basic C Programming Skills

Course Objective:

1. Real-time / embedded systems are designed to provide a timely response to0 real-world events.

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
3	0	2	5	4

Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	**Introduction of Embedded System** Embedded Micro controller Cores, Embedded Memories, SRAM, DRAM Controllers.	6	10
2	**ARM architecture**: ARM product profiles and features, Cortex M features and applications, performance, operation modes and privilege levels, switching of operation modes, register classification and importance, memory map, advantages of bit band region, aligned and unaligned access, endianness and performance	10	25
3	**Firmware Architecture for Embedded Systems**: Super Loop, Interrupt driven, RTOS, CMSIS RTOS, Low Power Operations. Speed Power Product, Optimization for time and space.	7	15
4	**Real time programming languages & operating systems for Embedded Systems:** Embedded programming in C/C++, Scheduler, Multitasking, Threading concepts and implementation	10	25
5	**Develop and troubleshoot real-time applications in embedded systems:** using GPP, FPGA and SPP, Debugging Techniques for Embedded System: Introduction to GNU Debugger (gdb), uVision and IDE-based debugging techniques.	9	25

Course Outcome:

Sr. No.	CO statement	Unit No
CO-1	Develop and analyze the Embedded Micro controller Cores	1
CO-2	Analyze the advanced features of ARM processors to develop efficient Embedded Systems	2
CO-3	Engage on market survey of various available embedded hardware and software architecture for performance, power and cost optimization. Present a report on the same.	3
CO-4	Develop and analyze programming languages & operating systems for Embedded Systems	4
CO-5	*Develop and troubleshoot real-time applications in embedded systems.*	5

Teaching & Learning Methodology: -

1. Direct Instruction
2. Flipped Classrooms
3. Kinesthetic Learning

4. Context-Based Learning

5. Adaptive Teaching

List of Experiments/Tutorials: **Total Hours:28**

Sr. No.	Practical Name
1	Develop services and instantiate them in different ways.
2	Create structures to realize special registers of ARM microcontroller.
3	Develop APIs to access individual bits/nibble/whole register contents and to configure MC for specific modes.
4	Create APIs to realise exception facilities as in ARM controllers (use unions).
5	Install Keil MDK for ARM along with development board drivers. Interface development board to development PC. Download and test blinky code example.
6	Develop a super loop to transmit ADC data on UART every „x" Unit-s of time.
7	Receive data from an analog sensor, digitize it and send it to display Unit-s of time

Major Equipment:

Any ARM Cortex M development board can be used.
Platform used: Kiel uVision MDK IDE, C compiler on Windows. Lab and Theory sessions are integrated.

Books Recommended: -

1.Joseph Yiu, "Definitive guide to the ARM Cortex-M3", Latest available edition

2. Hennessy and Patterson, "Computer Architecture: A Quantitative Approach",

Latest available edition 3. Michael J Pont, “Embedded C”, latest available edition

4. J. W. Valvo, Embedded Microcomputer system, Brooks/Cole.

5. K. J. Ayala, The 8051 Microcontroller, Pernam Intl.

6. Jack Ganssle. The art of designing Embedded Systems.

7. sDaniel W. Lewis, Fundamentals of Embedded Software

List of Open Source Software/learning websites:

· Embedded Software and Hardware Architecture by University of Colorado Boulder – Coursera

CO-PO Matrix:

CO No.	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO-1	3	3	2	-	-	-	-	-	-	-	-	-	1	1
CO-2	3	2	2	-	-	2	-	-	2	-	-	-	1	1
CO-3		3	3	-	2	-	-	-	-	-	-	-	1	1
CO-4	3	3	3	2	2	-	-	2	-	-	-	-	1	1
CO-5		3	-	-	-	2	-	-	-	-	-	2	1	1