SILVER OAK UNIVERSITY

Engineering and Technology (M.Tech.)

Electronics &Communication (Communication Systems Engg.)
Subject Name: Real Time Operating Systems for Embedded Systems
Subject Code:
Semester: II

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

Objective: Real time / embedded systems are designed to provide a timely response to real world events.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Evaluation Scheme				Total Marks
L	T	P	C	Internal		External		
				Th	Pr	Th	Pr	
3	0	2	4	40	20	60	30	150

Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	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.	5	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 an embedded system using different approaches: using GPP, using FPGA and as a SPP. Debugging Techniques for Embedded Systems: Introduction to GNU Debugger gdb. uVision IDE based debugging techniques.	8	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 embedded systems using different approaches	5

Teaching & Learning Methodology: -

1. Direct Instruction
2. Flipped Classrooms
3. Kinesthetic Learning
4. Context-Based Learning
5. Adaptive Teaching

List of Experiments/Tutorials:

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-.

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 Micro computer 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 website:

- Embedded Software and Hardware Architecture by University of Colorado Boulder – Coursera
- Embedded system Design IIT by AnupamBasu, IIT Kharagpur
https://nptel.ac.in/courses/106/105/106105159/