

1. Course Number and Name: 310 CPE – Embedded & Real Time Systems

2. Credits and Contact Hours: 3 Credit
 a.Lecture – 2 day per week at 50 minutes for 16 weeks
 b.Laboratory – 1 day per week at 100 minutes for 16 weeks

4. Text Book:

- Jane W. S. Liu, Real-Time Systems, Prentice Hall, 2000.
- C M Krishna ,Kang G Shin, Real time systems, McGraw-Hill, International editions 1997
- Rajkamal, Embedded systems, TATA McGraw-Hill,2009.

3.Course Coordinator or Instructor:
 Prof. Dr.Sasikumaran

5. Specific Course Information:

a. **Catalog Description:**This subject will introduce students to embedded systems by providing a detailed overview of the important topics in the field. It will introduce typical examples of embedded systems; real time and safety critical issues; constraint-driven design; systems integration; hardware-software partitioning and time-to-market considerations.

b. **Prerequisites:**220 CPE Microprocessor and Interfacing c. **Status:** Required

6.Specific Goals for the Course:

- a.Course Outcomes:**
1. Define the fundamental principles of Real time systems and Embedded systems
 2. Describe the recent events and current job market in Embedded and Real Time systems.
 3. Develop an ability to identify, formulate and solve embedded systems problems
 4. Develop an ability to design a system,components or process to meet desired needs within realistic constraints
 5. Explain impact of Embedded and Real Time systems in global, economic and societal context.
 6. Explain the techniques, skills and tools necessary for embedded systems practice.
 7. Demonstrate the work independently and within a team.

b.Student outcomes in Criterion 3 addressed by course:

Course LOs #	Map course LOs with the program LOs. (Place course LO #s in the left column and Student LO #s across the top.)											
	Student Learning Outcomes Use LOs Codes											
	a1	a2	b1	b2	b3	b4	c1	c2	c3	c4	d1	d2
1	√											
2		√										
3			√									
4				√								
5						√						
6							√					
7								√				

7. List of Topics: 310CPE – Embedded & Real Time Systems

List of Topics for Theory:

- **Introduction to Embedded and Real time systems:** Embedded systems overview, characteristics of embedded systems, Design challenges, embedded systems technologies, Moore's law.
- **Real Time Systems:** Introduction, Engineering applications of real time systems, Embedded/concurrent systems, an overview of typical real time systems, characteristics of real time systems, real time systems issues, notion of predictability.
- **Embedded processors/Microcontrollers and Peripherals :** Key technologies, single purpose processors, Micro controller, Microcontroller versus General purpose microprocessors, Micro controllers for embedded systems, X86 PC Embedded applications, Criteria for Choosing a micro controller.
- **Real time operating systems Task scheduling:** Introduction, Preemptive scheduling, Non preemptive scheduling, parallelizable task scheduling, priority driven preemptive scheduling approach, scheduling independent periodic tasks.
- **Resource reclaiming in multiprocessor real time systems:** Scheduler model, Dynamic scheduling model, resource reclaiming algorithms, properties of resource reclaiming algorithms.
- **Reliable system design:** Transient vs Permanent failures in hardware, sources of errors from software, Role of design verifications in reliable system design, Fault tolerant techniques.
- **Low power computing:** Sources of energy consumption, Strategies for power management, Memory system power consumption, Power consumption with multiple processes, System-level power management.

List of Topics for Laboratory:

- Introduction of lab view programming
- Building a VI
- Temperature log VI
- Determine warnings VI
- Array VI
- SbRIO: FPGA application
- Cluster data & generate global
- Comparison of numbers
- State machine
- Vision machine: snap & save to image file
- Formula node VI
- Stepper motor control VI