**Course outcomes:** At the end of the course, the students will be able to:

- Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
- Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.
- Demonstrate ability to design Combinational, sequential and dynamic logic circuits as per the requirements
- Interpret Memory elements along with timing considerations
- Interpret testing and testability issues in VLSI Design

**Question paper pattern:**

- Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.
- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- Students will have to answer 5 full questions, selecting one full question from each module.
- The total marks will be proportionally reduced to 60 marks as SEE marks is 60.

**TEXT BOOKS:**

**1.** "CMOS Digital Integrated Circuits: Analysis and Design" - **Sung Mo Kang & Yosuf Leblebici,** Third Edition, Tata McGraw-Hill.

**2. "CMOS VLSI Design- A Circuits and Systems Perspective"-** Neil H. E. Weste, and David Money Harris4th Edition, Pearson Education.

**REFERENCE BOOKS:**

1. Adel Sedra and K. C. Smith, "Microelectronics Circuits Theory and Applications", 6th or 7th Edition, Oxford University Press, International Version, 2009.
2. Douglas A Pucknell & Kamran Eshragian, "Basic VLSI Design", PHI 3rd Edition, (original Edition – 1994).
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", TMH, 2007.

**Professional Elective – 2**

**B. E. (EC/TC)**
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**
**SEMESTER – VII**

## REAL TIME SYSTEM

| | | | |
|---|---|---|---|
| **Course Code** | **18EC731** | **CIE Marks** | **40** |
| **Number of Lecture Hours/Week** | **03** | **SEE Marks** | **60** |
| **Total Number of Lecture Hours** | **40 (08 Hours per Module)** | **Exam Hours** | **03** |

**Credits – 03**

**Course Learning Objectives:** This Course will enable students to:

- Understand the fundamentals of Real-time systems and its classifications.
- Describe the concepts of computer control and hardware components for Real-Time Application.
- Discuss the languages to develop software for Real-Time Applications.
- Explain the concepts of operating system and RTS development methodologies.

| Module-1 | RBT Levels |
|---|---|
| **Introduction to Real-Time Systems:** Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs.<br>**Concepts of Computer Control:** Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. **(Text: 1.1 to 1.6 and 2.1 to 2.6)** | **L1, L2** |
| **Module-2** | |
| **Computer Hardware Requirements for Real-Time Applications:** Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface.<br>**(Text: 3.1 to 3.8).** | **L1, L2** |
| **Module-3** | |
| **Languages for Real-Time Applications:** Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Cutlass, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency, Real-Time Support, Overview of Real-Time Languages. **(Text: 5.1 to 5.14).** | **L1,L2, L3** |
| **Module-4** | |
| **Operating Systems:** Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion.**(Text: 6.1 to 6.11).** | **L1, L2** |
| **Module-5** | |
| **Design of RTS – General Introduction:** Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System.<br>**RTS Development Methodologies:** Introduction, Yourdon Methodology, Ward and Mellor Method, Hately and Pirbhai Method.<br>**(Text: 7.1 to 7.5 and 8.1, 8.2, 8.4,8.5).** | **L1, L2, L3** |

**Course Outcomes:** At the end of the course, students should be able to:

- Explain the fundamentals of Real time systems and its classifications.
- Understand the concepts of computer control and the suitable computer hardware requirements for real-time applications.
- Describe the operating system concepts and techniques required for real time systems.
- Develop the software algorithms using suitable languages to meet Real time applications.
- Apply suitable methodologies to design and develop Real-Time Systems.

**Text Book:**

Real-Time Computer Control, by Stuart Bennet, 2nd Edn. Pearson Education. 2008.