**Semester- I**

| Real Time Operating Systems | | | |
|---|---|---|---|
| Course Code | **MEC115E** | CIE Marks | 50 |
| Teaching Hours/Week (L:P:SDA) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning objectives:**

- To learn about Elements of a Computer Control System, RTS- Definition, Classification of Realtime Systems, Time Constraints, Sequence Control, Loop Control, Supervisory Control.
- To learn about Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Cutlass, Modularity and Variables, Data types, Control Structures.
- To learn about Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler

**Module-1**

**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.
**Concepts of Computer Control:** Introduction, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems.

**RBT Levels:** 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.

**RBT Levels:** L2, L3

**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.

**RBT Levels:** 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.

**RBT Levels:** L3, L4

**Module-5**

**Design of RTS- General Introduction:** Introduction, Specification Document, Preliminary Design. Single-Program Approach, Foreground/Background System. RTS Development Methodologies: Introduction, Yow-don Methodology, Ward and Mellor Method, Hately and Pirbhai Method.

**RBT Levels:**L3, L4

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

3. Two Unit Tests each of **25 Marks**
4. Two assignments each of **25 Marks**or **oneSkill Development Activity of 50 marks** to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.

**Suggested Learning Resources:**

**Books**

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

**Reference Books**

1. "Real-Time Systems", C.M. Krishna, Kang G Shin, McGraw-Hill International Editions, 1997.
2. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005.
3. Embedded Systems, Raj Kamal, Tata McGraw Hill, India, third edition, 2005.

**Web links and Video Lectures (e-Resources):**

- https://nptel.ac.in/

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Explain the fundamentals of Real time systems and its classifications. | L2, L3 |
| CO2 | Understand the concepts of computer control and the suitable computer hardware requirements for real-time applications. | L2 |
| CO3 | Describe the operating system concepts and techniques required for real time systems. | L3 |
| CO4 | Develop the software algorithms using suitable languages to meet Real time applications. | L2, L3, L4 |
| CO5 | Apply suitable methodologies to design and develop Real-Time Systems.. | L3 |