# SARVAJANIK UNIVERSITY
# Sarvajanik College of Engineering and Technology
# Bachelor of Technology

## Year: B.Tech III (Semester – V)

**Subject Name:** Cyber Physical Systems **Subject Code:** BTIT14503
**Type of course:** Professional Elective Course

**Rationale:** This course introduces cyber physical system to the students which focused on different ubiquitous applications we interact in our day to day life ranging from simple system to mission critical applications. This course aims to expose the student to cyber physical systems and provide a walk through the fundamentals, design and validation using real world examples.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | | Theory Marks | | | Practical Marks | | Total |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | C | TEE | CA1 | CA2 | TEP | CA3 | |
| 3 | 0 | 0 | 3 | 60 | 25 | 15 | - | - | 100 |

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in the course

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**Contents:**

| Sr. No. | Contents | Total Hours |
|---|---|---|
| 1. | **Introduction**: Cyber-Physical System, Key Features of CPS, Application Domains of CPS, Basic principles of design and validation of CPS, Challenges in CPS. | 06 |
| 2. | **CPS Platform components:** CPS HW platforms, Processors, Sensors and Actuators, CPS Network - Wireless, CAN, Automotive Ethernet, Scheduling Real Time CPS tasks, Synchronous Model and Asynchronous Model. | 10 |
| 3. | **Synchronous and Asynchronous Model:** Reactive Components, Components Properties, Components Composing, Synchronous Designs and Circuits, Asynchronous Processes and operations, Design Primitives in Asynchronous Process, Coordination Protocols in Asynchronous Process, Leader Election, Reliable Transmission. | 12 |
| 4. | **Security of Cyber-Physical Systems:** Introduction to CPS Securities, Basic Techniques in CPS Securities, Cyber Security Requirements, Attack Model and Countermeasures, Advanced Techniques in CPS Securities. | 10 |
| 5. | **CPS Application:** Health care and Medical Cyber-Physical Systems, Smart grid and Energy Cyber Physical Systems, WSN based Cyber-Physical Systems, Smart Cities. | 07 |

**Suggested Specification table with Marks (Theory): (For B. Tech only)**

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| **R Level** | **U Level** | **A Level** | **N Level** | **E Level** | **C Level** |
| 15 | 20 | 20 | 5 | - | - |

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (Revised Bloom's Taxonomy)

**Reference Books:**

| **Sr No.** | **Title of book /article** | **Author(s)** | **Publisher and details like ISBN** |
|---|---|---|---|
| 1 | Introduction to Embedded Systems: A Cyber-Physical Systems Approach | E. A. Lee and S. A. Seshia | MIT Press |
| 2 | Principles of Cyber-Physical Systems | R. Alur | MIT Press |
| 3 | Cyber-Physical Systems | Raj Rajkumar, Dionisio de Niz and Mark Klein | Addison-Wesley |
| 4 | Cyber-Physical Systems | Fei Hu | CRC Press |

**Note: Students should refer to the latest editions of books**

**Course Outcomes (CO):**

| **Sr. No.** | **CO statements** | **Marks % weightage** |
|---|---|---|
| CO-1 | Understand basic concept and components of Cyber Physical System. | 30% |
| CO-2 | Apply concepts of Synchronous and Asynchronous Modelling for Cyber Physical System. | 35% |
| CO-3 | Analyse various techniques for CPS Security. | 25% |
| CO-4 | Apply and analyse the applications in various processors and domains of embedded system. | 10% |