CYBER PHYSICAL SYSTEMS

Course Code	**23CS4702D**	**Year**	IV	**Semester**	I
Course Category	**PE-V**	**Branch**	**CSE**	**Course Type**	Theory
Credits	3	**L – T – P**	3-0-0	**Prerequisites**	Knowledge of embedded systems
Continuous Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	Understand symbolic synthesis techniques and apply them to construct controllers for cyber-physical systems.	L2
CO2	Apply system-theoretic approaches to address security challenges and develop countermeasures for cyber-physical systems.	L3
CO3	Apply synchronization techniques and distributed consensus algorithms to solve challenges in distributed cyber-physical systems.	L3
CO4	Analyze real-time scheduling methods and apply them to handle variability in multi-core cyber-physical systems.	L4

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3										3	2
CO2	3	3										3	2
CO3	3	3	3									2	2
CO4	3		3									2	2
Avg.	**3**	**3**	3									**3**	2

Syllabus

Unit No.	**CONTENTS**	**Mapped CO**
I	**Symbolic Synthesis for Cyber-Physical Systems:** Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools	**CO1**
II	**Security of Cyber-Physical Systems:** Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches	**CO2**

III	**Synchronization in Distributed Cyber-Physical Systems:** Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques	**CO3**
IV	**Real-Time Scheduling for Cyber-Physical Systems:** Introduction and Motivation, Basic Techniques - Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty	**CO4**
V	**Model Integration in Cyber-Physical Systems:** Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, ForSpec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.	**CO1,CO4**

Learning Resources
Text Books
1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional, 2016 2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press
Reference Books
1. E.A.Lee, Sanjit Seshia, Introduction to Embedded Systems: A Cyber-Physical Systems Approach, MIT Press 2. Andre Platzer, Logical Foundations of Cyber-Physical Systems, (2e), Springer Publishing, 2018
E-Resources & other digital material
1. https://www.coursera.org/specializations/cyber-physical-systems 2. https://www.edx.org/course/cyber-physical-systems-cps-in-smart-manufacturing