

COURSE SYLLABUS

**Name of the Group:** *Embedded System Group*

**Name of the Course:** Certificate course on *Cyber Physical Systems*

**Course Code:** *CPS100*

**Starting Date:** 25<sup>th</sup> February 2019

**Duration:** 4 Weeks

**Course Structure:** *This course contains total three modules. Case studies and mini projects will be available included in all modules of this course.*

<i>MC300</i>	<i>Module Name</i>	<i>Weeks</i>
<i>CPS-101</i>	<i>CPS - Platform &amp; Automated Control Design</i>	<i>2</i>
<i>CPS-102</i>	<i>CPS - implementation &amp; Safety Assurance Methods</i>	<i>1</i>
<i>CPS-103</i>	<i>CPS - Secure Deployment &amp; case studies</i>	<i>1</i>
	<b><i>Total</i></b>	<b><i>4</i></b>

a. Course Contents :

## **CPS 101: CPS - Platform & Automated Control Design**

**Module Duration: 10 days**

### **Objective**

This course covers the overview of cyber physical systems & its different platform aspects

### **Course Description**

#### **Cyber-Physical Systems Overview**

- i. Cyber-Physical Systems (CPS) in the real world
- ii. Basic principles of design and validation of CPS
- iii. Industry 4.0, AutoSAR, IIOT implications
- iv. Building Automation, Medical CPS

#### **CPS - Platform**

- i. CPS HW platforms - Processors, Sensors, Actuators
- ii. CPS Network - Wireless Hart, CAN, Automotive Ethernet
- iii. CPS Sw stack - RTOS
- iv. Scheduling Real Time control tasks

#### **Principles of Automated Control Design**

- i. Dynamical Systems and Stability
- ii. Controller Design Techniques
- iii. Stability Analysis: CLFs, MLFs, stability under slow switching
- iv. Performance under Packet drop and Noise

#### **Learning Outcomes**

After successful completion of the module, the students shall be able to understand the various platform aspects of cyber physical systems.

## **CPS 102: CPS - implementation & Safety Assurance Methods**

**Module Duration: 5 days**

### **Objective**

The objective of the module is to introduce various implementation & safety issues in CPS.

### **Course Description**

**CPS implementation**

- i. From features to software components, Mapping software components to ECUs  
CPS Performance Analysis - effect of scheduling, bus latency, sense and actuation  
faults on control performance

**Safety Assurance of Cyber-Physical Systems**

- i. Advanced modeling and analysis
- ii. Formal Analysis: Flow pipe construction, reach ability analysis

**Learning Outcomes**

After successful completion of the module, the students shall be able to:

- Understand the implementation basics and safety aspects of CPS.

**CPS 103: CPS - Secure Deployment & case studies**

**Module Duration:**5 days

**Objective**

The participants of this module will able to understand the security aspects of CPS and will see few case studies of CPS in different domains.

**Course Description**

**Secure Deployment of CPS**

- i. Attack models
1. Secure Task mapping and Partitioning
2. State estimation for attack detection
3. Case study

**Learning Outcomes**

After successful completion of this module, students should be able to get knowledge of security aspects of CPS.