	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM
Programme	**Bachelor of Technology in Computer Science & Engineering**	Year of Regulation: **2019-2020**
Department	**Computer Science & Engineering**	Semester: **IV**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
CS 216	**Cyber Physical Systems**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	COB1: To develop the student's ability to understand the concept of cyber physical systems' characteristics, requirements and architecture.		CO1	Students should be able to Understand the computer architectural design principles and performance enhancement strategies that adopted in performance evolution of different components of computer, microprocessor / microcontroller and Digital signal processor architecture and distributed memory architecture and distributed systems.
	COB2: To develop the student's ability to understand the fundamentals of microprocessor and micro-controller families and their architecture with special emphasis on Digital Signal Processors.			
	COB3: To provide the students with some knowledge and analysis skills associated with the principles of memory organisation and bus structure of cyber physical systems.		CO2	Students should be able to Solve the performance related problems of real time operating system.
	COB4: To develop the student's ability to understand the concepts of cyber physical system software with special emphasis on real time operating system and particularly real time job scheduling.			
	COB5: To provide the students with some basic knowledge of power aware architecture & hardware software co design.		CO3	Analyze the performance of embedded processing, memory, bus efficiencies, real time operating system performance h/w s/w codesign.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	3	1	1	-	-	-	-	1	1	-	-	2	-	1	-
2	CO2	3	3	2	2	2	-	-	1	1	-	-	2	1	1	-
3	CO3	3	3	3	2	2	-	-	2	2	-	-	2	2	2	-

SYLLABUS

No.	Content	Hours	COs
Module 1: Fundamentals of - Cyber Physical Systems	Cyber-Physical Systems (CPS) in the real world Basic principles of design and validation of CPS, Industry 4.0 AutoSAR, IIOT implications, Building Automation, Medical CPS	**5**	**CO1**
Module 2: Platform Components for Cyber Physical Systems	CPS HW platforms - Processors, Sensors, Actuators CPS Network - WirelessHart, CAN, Automotive Ethernet Scheduling Real Time CPS tasks: Table-driven and Event driven schedulers Hybrid schedulers	**8**	**CO1, 2 & 3**
Module 3: **Principles of Dynmical Systems**	Dynamical Systems and Stability Controller Design Techniques Performance under Packet drop and Noise	**8**	**CO1 & 2**
Module 4: **CPS implementation issues**	From features to automotive software components Mapping software components to ECUs CPS Performance Analysis: Effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion Building real-time networks for CPS	**8**	**CO1&2**
Module 5: **Intelligent CPS**	Safe Reinforcement Learning: Robot motion control, Autonomous Vehicle control Gaussian Process Learning: Smart Grid Demand Response, Building Automation	**7**	**CO1, 2 & 3**
Total Hours		**36**	

Essential Readings

1. Suh, Sang C., U. John Tanik, John N. Carbone, and Abdullah Eroglu, eds. *Applied cyber-physical systems*. Springer New York, 2014.
2. Alur, Rajeev. *Principles of cyber-physical systems*. MIT Press, 2015.
3. Colombo, Armando W., Thomas Bangemann, Statmatis Karnouskos, Jerker Delsing, Petr Stluka, Robert Harrison, Francois Jammes, and Jose L. Lastra. "Industrial cloud-based cyber-physical systems." *The Imc-aesop Approach* 22 (2014): 4-5.

Supplementary Readings

1. Andrew M Sloss, Dominic Symes, Chris Wright, "ARM System Developers Guide: Designing optimizing System Software" (Online resource)
2. http://eee.guc.edu.eg/Courses/Electronics/ELCT912%20Advanced%20Embedded%20Systems/Lectures/ARM%20System%20Developer%27s%20Guide.pdf
3. https://ptolemy.berkeley.edu/projects/cps/