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 214	**Computational Models for Real Time Systems**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	**COB1:** To develop the student's ability to understand the concepts of Real-Time Systems, their characteristics, requirements and architecture.	Course Outcomes	CO1	Students should be able to Understand the principles for modelling real-time tasks. The different scheduling policies, modelling complexities brought about by resource sharing among real-time tasks and scheduling among multiple processors.
	COB2: To develop the student's ability to understand different time of timing constraints and modelling various such timing constraints for model development.			
	COB3: To provide the students with some knowledge and analysis skills associated with the principles of real-time task scheduling.		CO2	Students should be able to Solve the scheduling and resource sharing related problems for real time systems.
	COB4: To develop the student's ability to understand the concepts of resource sharing and ways to handle dependencies among them.			
	COB5: To provide the students with some basic knowledge of multiprocessor scheduling modelling.		CO3	Analyze the performance of real-time systems with varying constraints and scenarios, including identifying performance bottlenecks.

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: Basic concepts and definitions related to Real Time Systems	Definition of Real-Time Systems, Applications of Real-Time Systems, Basic Model of a Real-Time System, Characteristics of Real-Time Systems, Safety and reliability, Taxonomy of Real-Time Systems, Timing constraints of Real-Time Systems, Events in Real-Time Systems, Modelling Timing Constraints in Real-Time Systems.	6	CO1, CO2
Module 2: Real-Time Task Scheduling	Basic concepts in real-time scheduling, Taxonomy of Real-Time Tasks and their characteristic, Tasks scheduling: Basic concepts and terminologies, Classification of Real-Time task scheduling algorithms, Clock-driven scheduling: Table-driven scheduling, Cyclic schedulers, Generalized Task schedulers, Cyclic Vs. Table-driven schedulers. Hybrid schedulers Event-driven schedulers: Earliest Deadline First (EDF), Rate Monotonic Scheduling (RMA), their comparative pros and cons. Other issues.	16	CO1, 2 & 3
Module 3: Handling resource sharing and dependencies among Real-Time Tasks	Resource sharing among real-time tasks, Priority inversion and means to handle priority inversion. Priority Inheritance Protocol (PIP) and Priority Ceil Protocol (PCP), Highest Locker Protocol (HLP). Different types of priority inversions under PCP, Handling Task dependencies.	8	CO1, 2 & 3
Module 4: Scheduling Real-Time Tasks in Multi-processor and Distributed Systems	Multi-processor task Allocation, Dynamic allocation of Tasks, Fault-tolerant allocation of tasks, Clocks in Distributed Real-Time Systems: Clock synchronization, centralized clock synchronization, Distributed clock synchronization	6	CO1&3
Total Hours		36	

Essential Readings

1. Mall, Rajib. *Real-time systems: theory and practice.* Pearson Education India, 2009.
2. Liu, Jane W S, *Real-time systems,* Pearson Education India, 2000.
3. Williams, Rob, *Real-time Systems Development,* Butterworth-Heinemann, Elsevier, 2006.

Supplementary Readings

1. Krishna , C. M.; Shin, Kang G., *Real-time systems,* Tata McGraw Hill, India, 2010.
2. Kopetz, Hermann. *Real-time systems: design principles for distributed embedded applications.* Springer Science & Business Media, 2011.
3. Laplante, Philip A. "Real-Time Systems Design and Analysis: An Engineer's Handbook, Piscataway." 1996.