Course code: Course Title	Course Structure			Pre-Requisite
SE320: Real Time Systems	L	T	P	Data Structures and Algorithms
	3	1	0	

Course Objective: The course addresses basic concepts of real-time systems, presents examples of real-time systems, covers real-time systems analysis and design, and gives an in-depth treatment of timing analysis and scheduling.

S. NO	Course Outcomes (CO)
CO1	Understand real-time system fundamentals, including timing constraints, task models, and application domains.
CO2	Analyze real-time scheduling approaches and algorithms to optimize task execution in dynamic and time-constrained systems.
CO3	Analyze resource access control mechanisms, including priority-based protocols.
CO4	Analyze multiprocessor system environments, scheduling algorithms, and task schedulability to optimize performance.
CO5	Analyze real-time communication models, protocols, and scheduling techniques.

S.No.	Contents	Contact Hours
UNIT 1	**Introduction:** Definition, Typical Real Time Applications; Digital Control, High Level Controls, Signal Processing etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	8
UNIT 2	**Real Time Scheduling:** Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	10
UNIT 3	**Resources Access Control:** Effect of Resource Contention and Resource Access Control (RAC), Non preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority-Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects	8
UNIT 4	**Multiprocessor System Environment:** Multiprocessor and Distributed System Model, Multiprocessor Priority-Ceiling Protocol, Schedulability of Fixed-Priority End-to-End Periodic Tasks, Scheduling Algorithms for End-to-End Periodic Tasks, End-to-End Tasks in Heterogeneous Systems, Predictability and Validation of Dynamic Multiprocessor Systems, Scheduling of Tasks with Temporal Distance Constraints.	8
UNIT 5	**Real Time Communication:** Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols, Real Time Protocols, Communication in Multicomputer System, An Overview of Real Time Operating Systems.	8
	TOTAL	42

REFERENCES		
S.No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1.	Jane W. S. Liu, "Real Time Systems", Pearson Education Publication.	**2000**
2.	Hermann Kopetz, Wilfried Steiner, "Real Time Systems: Design Principle for Distributed Embedded Applications", Kluwer Academic, 3rd Edition.	**2022**
3.	Bruce Powel Douglass, "Real Time UML: Advances in the UML for Real-Time Systems", Addison-Wesley, 3rd Edition.	**2013**