Course Title: Real Time System
Course no: CSC-354 **Full Marks**: 90+10
Credit hours: 3 **Pass Marks**: 2 + 8

Nature of course: Theory (3 Hrs.)

Course Synopsis: This course introduces the real time technology
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Goal: The main objective of this course is to address issue in scheduling, resource access control, and communication in the real time system

Unit 1. Introduction **3 Hrs.**

Digital control, High-level controls, Signal processing, Real time applications

Unit 2. Hard versus Soft Real-Time Systems **4 Hrs.**

Jobs and processors, Release times, Deadlines, and timing constraints, Hard and soft timing constraints, Hard real-time systems, Soft real-time systems,

Unit 3. Reference Model of Real-Time Systems **4 Hrs.**

Processor and resources, Temporal parameters of real-time workload, Periodic task model, Precedence constraints and data dependency, Other dependencies, Functional parameters, Resource parameters of jobs and parameters of resources, Scheduling hierarchy

Unit 4. Approaches to Real-Time Scheduling **4 Hrs.**

Clock-driven approach, Weighted round-robin approach, Priority-driven approach, Dynamic versus static system, Effective release times and deadlines, Optimality of the EDF and LST algorithms, Nonoptimality of the EDF and LST algorithms, Challenges in validating timing constraints in priority-driven systems, Off-line versus on-line scheduling,

Unit 5. Clock-Driven Scheduling **5 Hrs.**

Notations and assumptions, Static, Timer-driven scheduler, General structure of cyclic schedules, Cyclic executives, Improving the average response time of aperiodic jobs, Scheduling sporadic jobs, Practical considerations and generalization, Algorithm for constructing static schedules, Pros and cons of clock-driven scheduling

Unit 6. Priority-Driven Scheduling of Periodic Tasks **6 Hrs.**

Static assumption, Fixed-priority versus dynamic-priority algorithms, Maximum schedule utilization, Optimality of the RM and DM algorithms, A schedulability test for fixed-priority tasks with short response times, schedulability test for fixed-priority

tasks with arbitrary response times, Sufficient schedulability conditions for the RM and DM algorithms, Practical factor

Unit 7. Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems 6 Hrs.

Assumptions and approaches, Deferrable servers, Sporadic servers, Constant utilization, total bandwidth, and weighted fair-queuing servers, Slack stealing in deadline-driven systems, Slack stealing in fixed-priority systems, Scheduling of sporadic jobs, Real-time performance for jobs, with soft timing constraints, Low-level scheme for integrated scheduling

Unit 8. Resources and Resource Access Control 5 Hrs.

Assumptions on resources and their usage, Effects of resources contention and resource access control, Nonpreemptive critical sections, Basic priority-inheritance protocol, Basic priority-ceiling protocol, Stack-based, priority-ceiling (ceiling-priority) protocol, Use of priority-ceiling protocol in dynamic-priority system, Preemption-ceiling protocol, Controlling accesses to multiple-unit resources, Controlling concurrent accesses to data objects,

Unit 9. Multiprocessor Scheduling, Resource Access Control and Synchronization 5 Hrs.

Model of multiprocessor and distributed systems, Task assignment, Multiprocessor priority-ceiling protocol, Elements of scheduling algorithms for end-end periodic tasks, End-to-end tasks in heterogeneous systems, Predictability and validation of dynamic multiprocessor systems.

Unit 10. Real –Time Communication 6 Hrs.

Model of real-time communication, Priority-based service disciplines for switched networks, Weighted round-robin service disciplines, Medium access-control protocols of broadcast networks, Internet and resource reservation protocols, Real-time protocol, Communication in multi computer systems

Text / Reference Book:

1. Real-Time Systems, Jane W. S. Liu, Pearson Education Asia, 2003

