Tribhuvan University

Institute of Science and Technology

Bachelor of Computer Science and Information Technology

Detailed-Syllabus: Real Time Systems (CSC-354)

Sixth Semester

Lesson Plan:

S.N.	Chapters	Descriptions	Time Hrs.	Hours
1.	Unit 1. Introduction	Digital control - example	0.5	3
		High level controls – examples of control hierarchy, guidance and control, real time commands and control	1	
		Signal processing – radar system	0.5	
		Real time applications – issues and examples	1	
2.	Unit 2. Hard versus Soft real time systems	Jobs and processors, release time, deadlines and timing constraints, hard and soft timing constraints	1.5	4
		Common definitions, hard timing constraints and temporal quality of service guarantees	0.5	
		Hard real time systems	1	
		Soft real timing systems	1	
3.	Unit 3. Reference model of real time systems	Processors and resources, temporal parameters of real time workload	1	4
		Periodic task model	1	
		Precedence constraints and data dependency, other dependency	1.5	
		Functional parameters-figure of usefulness function, resource parameters-concepts only, scheduling hierarchy-concepts only	0.5	
4.	Unit 4. Approaches to real time scheduling	Clock driven approach, weighted round Robin approach, priority driven approach, dynamic versus static systems	1.5	4
		Effective release time-example, optimality of EDF & LST algorithms-theorem (with proof)/corollary (without proof) and example, Non-optimality of EDF & LST algorithms-theorem/corollary (without proof) and example	2	
		Challenging in validating timing constraints in priority driven systems-anomalous behavior of priority driven systems with example only, office versus online scheduling-concepts only	0.5	
5.	Unit 5. Clock driven scheduling	Notations and assumptions. Static, time driven scheduler, general structure of cyclic schedules	2.5	5
		Cyclic executives-concept only (without algorithm), improving the average response time of aperiodic jobs-slack stealing with an example, scheduling sporadic jobs-acceptance test, EDF scheduling of accepted	1.5	

		jobs with an example (without algorithm)		
		Practical considerations- concepts only, algorithm for constructing static schedules- network flow graph only, pros and cons of clock driven scheduling-concepts only	1	
6.	Unit 6. Priority driven scheduling of periodic tasks	Static assumptions, fixed priority versus dynamic priority algorithms – (without relative merits)	2	6
		Maximum schedule utilization-theorem (without proof), example of infeasible EDF schedules, optimality of RM & DM algorithms- only (without proof)	1	
		Scheduling test for fixed priority tasks with short response times-critical instants, theorem (without proof) and example, schedulability test for fixed priority tasks with arbitrary response times-busy intervals, general scheduling test (general time demand analysis method- statements only)	1.5	
		Sufficient schedulability conditions for RM & DM algorithms- theorem only (without proof), practical factors- concepts only	1.5	
7.	Unit 7. Scheduling aperiodic and sporadic jobs in priority driven systems	Assumptions and approaches- objectives, correctness and optimality only, deferrable servers- operations of deferrable servers only, sporadic servers- sporadic server in fixed priority systems only	3	6
		[Constant utilization, total bandwidth and weighted fair queuing servers]- concepts, theorems/corollary (without proof) only	1	
		Slack stealing in deadline driven systems- example of deadline stealer, slack stealing in sixed priority systems-optimality criterion and design consideration with an example, [scheduling of sporadic jobs- real time performance for jobs with soft timing constraints, two level scheme for integrated scheduling]- basic concepts only	2	
8.	Unit 8. Resources and resource access control	Assumptions on resources and their usage, effects of resources contention and resource access control	1	5
		Non-preemptive critical sections, basic priority inheritance protocol-definition of basic priority inheritance protocol	1	
		Basic priority ceiling protocol- definition of basic priority ceiling protocol, stack based, priority ceiling (ceiling priority) protocol- motivation and definition of stack sharing priority ceiling protocol	1	
		Use of priority ceiling protocol in dynamic priority systems- implementation of priority	1	

		ceiling protocol in dynamic priority systems. Preemption ceiling protocol- preemption levels of jobs and periodic tasks, definitions of protocols and duration of blocking (motivation and assumptions only)		
		Controlling access to multiple unit resources- priority (preemption) ceiling of multiple unit resources, controlling concurrent accesses to data objects- convex ceiling protocol(motivation and assumptions only)	1	
9.	Unit 9. Multiprocessor scheduling. Resource access control and synchronization	Model of multiprocessor and distributed systems	1.5	5
		Task assignment- task assignment based on execution time requirements (simple bin packing formulation only), multiprocessor priority ceiling protocol- blocking time due to resource contention	1.5	
		Elements of scheduling algorithms for end-end periodic tasks- interprocessor synchronization protocols (greedy synchronization protocol only), end-to-end tasks in heterogeneous systems- corollary (without proof)	1.5	
		Predictability validation of dynamic multiprocessor systems	0.5	
10.	Unit 10. Real time communication	Model of real time communication	1	6
		Priority based service disciplines for switched networks- weighted fair queuing discipline	1	
		Weighted round Robin service disciplines- greedy WRR discipline	1	
		Medium access control protocol of broadcast networks- medium access protocols in CAN and IEEE 802.5 token ring	1	
		Internet and resource reservation protocols- issues in resource reservation	0.5	
		Real time protocols	1	
		Communication in multi computer systems- wormhole networks	0.5	
			Total	45