FR-1	Exam Review	FR-1	FR-2		FR-2
Test Conditio			How to Allo	ocate Study Time:	
Closed Book, C			10% How an		
	$m \times 280 \text{ mm}$ note sheet, eyes only.			errupts work.	
Calculator allo			25% Solve tin	ming problems.	
	rganizers, PDAs, computers, or other devices			g on conditioning problems.	
	ore significant amounts of text.		10% How tra	unsducers and sensors work.	
Test Format a	and Topics		15% Miscella	neous.	
	minutes, this room, Friday 7 May 1999.				
	00-12:00 (noon).		How To Pre	ppare	
	s and one set of short-answer questions.		Study mater	ial.	
Comprehensive	-		If necessary,	re-solve this semester's homework assignments.	
Å			Solve past he	omework and exam problems.	
			N.B., solving	g a problem <u>is not</u> the same as memorizing a solution.	
FR-1	$\rm EE$ 4770 Lecture Transparency. Formatted 9:53, 30 April 1999 from Islifr.	FR-1	FR-2	EE 4770 Lecture Transparency. Formatted 9:53, 30 April 1999 from Islifr.	FR-2
FR-3		FR-3	FR-4	Overview of Real Time Systems	FR-4
FR-3 This Review:		FR-3	FR-4 Parts of RT		FR-4
This Review:	f Real Time Systems	FR-3	Parts of RT		FR-4
This Review:		FR-3	Parts of RT Sensor, Actu	S	FR-4
This Review: • Overview o • Conditionin		FR-3	Parts of RT Sensor, Actu Know how ea	S ator, Process, Computer	FR-4
This Review: • Overview o • Conditionin	ng Problems	FR-3	Parts of RT Sensor, Actu Know how ea Know how R	S ator, Process, Computer ach part fits into whole system.	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr	ng Problems	FR-3	Parts of RT Sensor, Actu Know how ea Know how R are different	S ator, Process, Computer ach part fits into whole system. T computer hardware and software	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits	ng Problems ansducers, and Physical Quantities	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software.	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits • Error	ng Problems ansducers, and Physical Quantities	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits • Error • OS Overvie	ng Problems ansducers, and Physical Quantities w uling	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits • Error • OS Overvie • Task Sched	ng Problems ansducers, and Physical Quantities w uling fechanism	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits • Error • OS Overvie • Task Sched • Interrupt M	ng Problems ansducers, and Physical Quantities w uling Iechanism 'iming	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits • Error • OS Overvie • Task Sched • Interrupt M • Interrupt T	ng Problems ansducers, and Physical Quantities ew uling fechanism Yiming signment	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits • Error • OS Overvie • Task Sched • Interrupt M • Interrupt T • Priority As • Schedulabil	ng Problems ansducers, and Physical Quantities ew uling fechanism Yiming signment	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS	FR-4
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits • Error • OS Overvie • Task Sched • Interrupt M • Interrupt T • Priority As • Schedulabil	ng Problems ansducers, and Physical Quantities w uling Iechanism Yiming signment iity Tests	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS	FR-4
 This Review: Overview o Conditionin Sensors, Tr Circuits Error OS Overvie Task Sched Interrupt M Interrupt T Priority As Schedulabil Resource B 	ng Problems ansducers, and Physical Quantities w uling fechanism 'iming signment ity Tests locking and Deadlock		Parts of RT Sensor, Actu Know how R are different Challenges Specification	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS , testing, evaluating reliability.	
This Review: • Overview o • Conditionin • Sensors, Tr • Circuits • Error • OS Overvie • Task Sched • Interrupt M • Interrupt T • Priority As • Schedulabil	ng Problems ansducers, and Physical Quantities w uling Iechanism Yiming signment iity Tests	FR-3	Parts of RT Sensor, Actu Know how e Know how R are different Challenges	S ator, Process, Computer ach part fits into whole system. T computer hardware and software ent than general purpose computer and software. in Building a RTS	FR-4

FR-5	Typical Problem	FR-5	FR-6	FR-6
	vert a process variable value ectrical or information quantity.		Conditioning Circuit Response Analog to Digital Conversion and	
Solution to T	ypical Problem:		The Desired Output	
• Identify wh	nat is given and what output is needed.		Each problem has its own constraints	
	identify what form output is needed in: , current, number written in a computer memory, etc.		those constraints must be identified and the circuit designed accordingly.	
	nsducer (or use one specified) ert process variable to a raw electrical quantity.			
• Choose and	alog-to-digital converter, if necessary.			
to conv to a for or to th	ditioning circuit ert raw electrical quantity m suitable for an analog-to-digital converter e form requested in the problem statement hatever form is specified in the problem.			
• Design inte	erface routine.			
Interface re Transducer	putine must account for: Response			
FR-5	EE 4770 Lecture Transparency. Formatted 9:53, 30 April 1999 from Islifr.	FR-5	FR-6 EE 4770 Lecture Transparency. Formatted 9:53, 30 April 1999 from Islifr.	FR-6
FR-7	Transducans and Sansans	FR-7	FR-8 Temperature Transducers	FR-8
FR-7	Transducers and Sensors	FR-7	FR-8 Temperature Transducers	FR-8
For every sen	sor and transducer:	FR-7	Temperature Definition	FR-8
For every senBe able to	sor and transducer: explain how it works.	FR-7	Temperature Transducers	FR-8
For every sen • Be able to • Know its s	sor and transducer:	FR-7	Temperature Definition	FR-8
For every sen • Be able to • Know its s relative	sor and transducer: explain how it works. trengths and weaknesses	FR-7	Temperature Definition Know definition of thermodynamic and practical scales.	FR-8
 For every sen Be able to Know its s relative Understand 	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity.	FR-7	Temperature Definition Know definition of thermodynamic and practical scales. Thermistor	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured.	FR-7	Temperature Transcucers Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function.	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured. action was presented in class:	FR-7	Temperature Transducers Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function. Know how to use linearization circuit (shunt resistor).	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured. action was presented in class:	FR-7	Temperature Transducers Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function. Know how to use linearization circuit (shunt resistor). RTD Know how to use three-wire bridge connection.	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured. action was presented in class:	FR-7	Temperature Transducers Temperature Transducers Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function. Know how to use linearization circuit (shunt resistor). RTD Know how to use three-wire bridge connection. Thermocouple	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured. action was presented in class:	FR-7	Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function. Know how to use linearization circuit (shunt resistor). RTD Know how to use three-wire bridge connection. Thermocouple Know how to use tables.	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured. action was presented in class:	FR-7	Temperature Transducers Temperature Transducers Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function. Know how to use linearization circuit (shunt resistor). RTD Know how to use three-wire bridge connection. Thermocouple	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured. action was presented in class:	FR-7	Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function. Know how to use linearization circuit (shunt resistor). RTD Know how to use three-wire bridge connection. Thermocouple Know how to use tables.	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured. action was presented in class:	FR-7	Temperature Transducers Temperature Transducers Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function. Know how to use linearization circuit (shunt resistor). RTD Know how to use three-wire bridge connection. Thermocouple Know how to use tables. Know how to use isothermal block.	FR-8
For every sen • Be able to • Know its s relative • Understand If a model fun	sor and transducer: explain how it works. trengths and weaknesses to other sensors measuring same physical quantity. d the units in which the process variable is measured. action was presented in class:	FR-7	Temperature Transducers Temperature Definition Know definition of thermodynamic and practical scales. Thermistor Know how to derive linear model from model function. Know how to derive linear model from model function. Know how to use linearization circuit (shunt resistor). RTD Know how to use three-wire bridge connection. Thermocouple Know how to use tables. Know how to use isothermal block. Integrated Temperature Sensor	FR-8

FR-9	FR-9	FR-10 FR-10	-10
Light Sensors Units Definition of different quantities, <i>e.g.</i> , irradiance. Radiometric <i>v.</i> photometric units. Know how to convert between quantities under simple situations. Photodiode, phototransistor. Vacuum-tube photocell, photomultiplier.		Displacement and Proximity Sensors Otentiometer Japacitive Japacitive v. absolute types. Know gray/binary conversion. Aeed Switch fall Effect Magnetic Reluctance Dross-correlation speed sensor.	2
FR-9 EE 4770 Letture Transporency. Formatted 363, 30 April 1999 from lalift.	FR-9	FR-10 EE 4770 Leture Thunsparency. Permatted 9534, 30 April 1999 from latifi. FR-10	-10
F41 Krain, Force, and Presure Units Finition of strain, force, and presure. Definition of strain, force, and presure. Different measures of presure. Strain Gauge Finition of strain of presure. Derivation of strain of presure. Derivation of large-displacement sensor. Costruction of large-displacement sensor. Dustruction of large-displacement sensor. Costruction of large-displacement sensor. Mathematical Strain of the sensor.	FR-11 FR-11	F1-3 F1-34 Flow Units, etc. Units, etc. Messures of flow: volumetric, mass, velocity. Messures of flow: volumetric, mass, velocity. Messures of flow: volumetric, mass, velocity. Open v. closed conduit. Fluid v. slumy. Sensors Sensors Mid v. slumy. Sensors Messures of flow: volumetric, mass, velocity. Messures of flow: volumetric, mass, velocity. Messures of flow: volumetric Messures of flow: volumetric Messures Messures Messures Messures	ç. Ç

FR-13		FR-13	FR-14	Circuits	FR-14
Chemical			Amplifiers		
Gas Sensors			Non-Inverting Amplifier		
Humidity.			The Versatile Inverting A	mplifier	
Oxygen.			"Plain" inverting amp		
			Summing amplifier.		
Fluid			Gain/offset amplifier.		
Reference electrod			Current-to-voltage con	werter.	
Ion concentration.					
			Instrumentation Amplifie	er (
			Other Circuits		
			Wheatstone bridge.		
			Know how to place con	mplementary pairs in bridge.	
			Know exact and appro	oximate formulæ.	
FR-13	EE 4770 Lecture Transparency. Formatted 9:53, 30 April 1999 from Islifr.	FR-13	FR-14 EE	4770 Lecture Transparency. Formatted 9:53, 30 April 1999 from Islifr.	FR-14
		-			
FR-15		FR-15	FR-16		FR-16
FR-15		FR-15	FR-16 Operating Systems		FR-16
Error	of error	FR-15	Operating Systems	tion	FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca	tion.	FR-16
Error Know definitions	of error. rror is in the process-variable value, not the transducer output.	FR-15	Operating Systems Function: resource alloca Tasks		FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks	tion. k, program, and executable.	FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks		FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas		FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management		FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states.		FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states. Context switching. Scheduling		FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states. Context switching. Scheduling Scheduling events.	k, program, and executable.	FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states. Context switching. Scheduling Scheduling events. Quantum and preempt	k, program, and executable.	FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states. Context switching. Scheduling Scheduling events. Quantum and preempt Scheduling methods.	k, program, and executable.	FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states. Context switching. Scheduling Scheduling events. Quantum and preempt	k, program, and executable.	FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states. Context switching. Scheduling Scheduling events. Quantum and preempt Scheduling methods.	k, program, and executable.	FR-16
Error Know definitions		FR-15	Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states. Context switching. Scheduling Scheduling events. Quantum and preempt Scheduling methods. Performance Measures.	k, program, and executable.	FR-16
Error Know definitions of Remember that en	rror is in the process-variable value, not the transducer output.		Operating Systems Function: resource alloca Tasks Difference between tas Task Management Task states. Context switching. Scheduling Scheduling events. Quantum and preempt Scheduling methods. Performance Measures.	k, program, and executable. tion.	

FR-17	FR-17	FR-18		FR-18
Interrupt Mechanisms Hardware needed		Priority Assignment Cvelic Executive	Priority Assignment and Static Scheduling Cvelic Executive	
Steps in interrupt sequence.		Rate Monotonic Scheduling	luling	
Strong v. weak priority.		Schedulability Tests		
Different types of interrupts.		Locking and Blocking and Deadlocking	g and Deadlocking	
Estimating Latency One-shot. Periodic exhaustive. Periodic statistical.		Use of resources, need for locking. Locking protocols. Timing with resource locking. Deadlock avoidance.	for locking. locking.	
FR-17 DE 4770 Letture Transparency. Formatted 3:53, 30 April 1990 from latifi-	FR-17	FR-18	EE 4770 Lecture Transparence. Formatted 2.63, 30 April 1999 from latific.	FR - 18