

The University of Texas at Tyler  
Department of Electrical Engineering

EENG 5336: Real Time Systems

Syllabus

Catalog Description:

Basic Real-Time Concepts; Computer Hardware; Languages; Real-Time Kernels; Intertask Communication and Synchronization; Real-Time Memory Management; The Software Life Cycle; System Performance Analysis and Optimization; Reliability, Testing, and Fault Tolerance; Hardware/Software Integration; Integrated lab experiments with state-of-the-art real-time hardware and software tools. Graduate level term project or paper.

Prerequisites: EENG 3307 or CI

Credits: 3 ( 0 hours lecture, 0 hours laboratory per week )

Text(s): Mukul Shirvaikar and Theodore Elbert, **Fundamentals of Real Time Systems**, Cognella Academic Publishing, San Diego, CA, 2017. ISBN 978-1-5165-0189-2, 978-1-5165-0188-5

Additional Material: ARM Board and Development Tools

Course Coordinator: Mukul V. Shirvaikar, Professor

Topics Covered: (paragraph of topics separated by semicolons)

Basic Real-Time Concepts; Computer Hardware; Languages; Real-Time Kernels; Intertask Communication and Synchronization; Real-Time Memory Management; The Software Life Cycle; System Performance Analysis and Optimization; Reliability, Testing, and Fault Tolerance; Hardware/Software Integration; Integrated lab experiments with state-of-the-art real-time hardware and software tools.

Evaluation Methods: (only items in dark print apply):

1. Examinations / Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Learning Outcomes<sup>1</sup>: By the end of this course students will be able to:

1. Apply real time and embedded systems concepts including requirements, complexity, tasks, and deadlines [1,4,5]
2. Utilize modern tools to implement hands-on projects with real time systems [1,4,5]
3. Predict real time systems reliability using advanced scheduling techniques, e.g. Rate Monotonic Analysis, worst-case latency, etc. [1,5].

4. Understand real time operating systems, kernels, software design, inter-task communications, and memory management [1,4,5]
5. Implement and debug real time systems projects using various design methods such as cyclic executives, round-robin thread switching, preemptive tasks with priorities, etc.[1,3]
6. Describe the impact of real time systems on society. [1]

<sup>1</sup>Numbers in brackets refer to method(s) used to evaluate the course learning outcomes.

Relationship to Student Outcomes (only items in dark print apply)<sup>2</sup>: This course supports the following Electrical Engineering Student Outcomes, which state that our students will:

1. **Breadth and Depth:** Students will be able to apply knowledge at a graduate level in two of the following areas: electronics, power systems, controls, advanced engineering mathematics, signal processing, communications, real-time systems, computer systems, electromagnetic and power electronics. [1]
2. **Modern Engineering Tools:** Students will be able to use modern engineering tools for analysis and design as applied to engineering problems. [2]
3. **Advanced Engineering Mathematics:** Students will be able to apply principles of advanced engineering mathematics including probability and statistics to engineering problems. [3]
4. **Systems Design:** Students will be able to apply systems design approaches including modeling and simulation of interacting sub-systems to complex engineering problems. [4]
5. **Design Methods:** Students will be able to demonstrate application of design methodology by comparing and evaluating solutions to engineering problems.[5]
6. **Communication Skills:** Students will demonstrate effective oral, visual and written communication skills from a technical perspective. [6]

<sup>2</sup>Numbers in brackets refer to course objective(s) that address the Student Outcome.

Contribution to Meeting Professional Component: (in semester hours)

Mathematics and Basic Sciences:		hours
Engineering Sciences and Design:	3	hours
General Education Component:		hours

Grade Replacement:

If you are repeating this course for a grade replacement, you must file an intent to receive grade forgiveness with the registrar by the 12th day of class. Failure to file an intent to use grade forgiveness will result in both the original and repeated grade being used to calculate your overall grape point average. A student will receive grade forgiveness (grade replacement) for only three (undergraduate student) or two (graduate student) course repeats during his/her career at UT Tyler. (2006-08 Catalog, p. 35)

Prepared By: Mukul Shirvaikar, Professor

Date: 17 July 2014  
28 August 2016  
23 August 2018

**The University of Texas at Tyler  
Department of Electrical Engineering**

**EENG 5336: Real Time Systems  
2018 Fall Semester**

**COURSE OUTLINE**

Course Coordinator: Dr. Mukul V. Shirvaikar, Electrical Engineering  
Office: RBN 2014  
Phone: 903-565-5620  
E-mail: [mshirvaikar@uttyler.edu](mailto:mshirvaikar@uttyler.edu)  
Website: <http://www.uttyler.edu/ee>

Class Location/Time: RBN 2012/HEC 0A218 6:00PM-8:45PM T

Grading Policy:

Quizzes	20%
Mid-Term Examination	25%
Laboratory Projects	30%
Final Examination	25%

**Note:** Students are required to complete all labs to obtain a passing grade in the class. Instructor reserves the right to modify the above grading policy including final grade thresholds at any point of time.

Semester Schedule:

WEEK	DATE	TOPICS COVERED	READING ASSIGNMENT	LABORATORY
1	27-Aug-2018	Introduction to Real Time Systems	Chapter 1	Order ARM Board
2	3-Sep-2018	Real Time Systems Programming	Chapter 2	
3	10-Sep-2018	Real Time Systems Programming	Chapter 2	
4	17-Sep-2018	Data Structures	Chapter 3	
5	24-Sep-2018	Data Structures	Chapter 3	
6	1-Oct-2018	Real Time Operating Systems	Chapter 4	Lab 1 - Getting Started
7	8-Oct-2018	Real Time Operating Systems <b>Midterm Review</b>	Chapter 4	Lab 2 - Real Time Development Tools
8	15-Oct-2018	ARM RTX RTOS <b>MIDTERM EXAM Tuesday, Oct. 17</b>	ARM Documentation	
9	22-Oct-2018	Task Scheduling Algorithms	Chapter 5	Lab 3 - Creating a New Project
10	29-Oct-2018	Task Scheduling Algorithms	Chapter 5	Lab 4 - Real Time Operating System
11	5-Nov-2018	Communication Mechanisms	Chapter 6	Lab 5 - RTOS Debugging Tools
12	12-Nov-2018	Reliability Protocols	Chapter 6	Lab 6 - DSP Applications
13	19-Nov-2018	<b>NO CLASS</b>		<b>THANKSGIVING</b>
14	26-Nov-2018	Application Notes	Chapter 7	Lab 7 - Creating RTOS Projects
15	3-Dec-2018	Application Notes	Chapter 7	
16	10-Dec-2018	<b>FINAL EXAM Tuesday, Dec. 11, 6:30PM-8:30PM</b>		

NOTE: Please maintain a class folder with all your work including class notes, homework and lab assignments, quizzes, and mid-term exam.

## Homework, Examination and Lab Project Policy:

Homework and project reports will be due in Canvas one week after assignment. Project reports should be written as per the guidelines provided. A 25% penalty will be assessed for missing the submission deadline and an additional 25% penalty will apply per week for late project reports and homework. Any deviation from this rule will be at the sole discretion of the instructor.

**All submissions are required to be in Microsoft Word format with machine readable text and not images or other representations of text. This rule will be applied to all sections of the report including the appendices and program code with comments. All flowcharts and diagrams must be prepared using Microsoft Office and not by hand. Any attempts to defeat the plagiarism checking software by submission of documents that include images instead of body text or any other mechanism will result in a grade of zero. The instructor or responsible grader reserves all rights to make this judgement and reject a project report if the above rules are not followed. Any violations may result in ACADEMIC DISHONESTY charges to be filed against the student.**

Student waives all rights to a make-up exam if they miss a scheduled testing date. Any make-up testing will be at the sole discretion of the instructor.

## Attendance Policy:

**Students are expected to attend all scheduled lectures and lab meetings.** By signing up for the class it is understood that the student has checked for ANY significant recurring conflicts with lecture and laboratory meeting times (including work, family, or any other commitments). No exceptions can be made for attendance requirements as this will be unfair to the other students. **The progressive nature of the class means that perfect attendance is recommended if a good grade is desired. No more than three excused absences for valid reasons are allowed and documentation should be submitted for each absence.**

## Student Conduct Policy:

Any behavior which distracts from the learning experience of other students including sleeping in class is not allowed and will result in corrective action by the instructor/staff. Students are also expected to follow all safety rules and guidelines in the laboratory setting.

## Academic Integrity:

Students should be aware that absolute academic integrity is expected of every student in all undertakings at The University of Texas at Tyler. Failure to comply can result in strong university-imposed penalties. **All lab reports and assignments will be verified using plagiarism checking software and violations will result in a grade of zero for the lab report or assignment at a minimum, and possibly stronger penalties such as a failing grade in the course and a scholastic dishonesty report submitted to the university.**

## **Students Rights and Responsibilities**

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link:  
<http://www.uttyler.edu/wellness/rightsresponsibilities.php>

## **Grade Replacement/Forgiveness and Census Date Policies**

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at <http://www.uttyler.edu/registrar>. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar. Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average.

Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract. The Census Date is the deadline for many forms and enrollment actions that students need to be aware of. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

## **State-Mandated Course Drop Policy**

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date). Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

## **Disability Services**

In accordance with federal law, a student requesting accommodation must provide documentation of his/her disability to the Disability Services counselor. If you have a disability, including a learning disability, for which you request an accommodation, please contact the Disability Services office in UC 3150, or call (903) 566-7079.

**Student Absence due to Religious Observance**

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

**Student Absence for University-Sponsored Events and Activities**

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

**Social Security and FERPA Statement:**

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

**Emergency Exits and Evacuation:**

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.