The University of Texas at Tyler
Department of Electrical Engineering

EENG 3307: Microprocessors and Embedded Systems (required)

Syllabus

Catalog Description:

Microprocessor architecture, programming and interfacing. Introduction to assembly language programming; Microcomputers, microcontrollers, instruction set, chip interfacing, addressing modes, interrupts, input/output, communication. Hardware/software interfacing and embedded systems applications. Three hours of lecture per week with integrated laboratory sessions. **Prerequisites:** EENG 3302 and COSC 1336

Prerequisites: EENG 3302 - Digital Systems, COSC 1336 – Programming

Credits: (2 hours lecture, 3 hours laboratory per week)

Text(s): Ronald J. Tocci and Frank J. Ambrosio, **Microprocessors and Microcomputers: Hardware and Software, 6th ed**. Prentice Hall, 2003
ISBN: 0-13-060904-8, ISBN-13: 9780130609045

Additional Material: Motorola 68HC11 Development Board. Laboratory projects are integrated to provide students with hands-on experience.

Course Coordinator: Mukul V. Shirvaikar, Professor

Topics Covered: (paragraph of topics separated by semicolons)

Microcomputer Fundamentals: number systems, codes, digital circuits, memory devices, and introduction to computers; Microprocessors: elements, structure, operation, memory, bus architecture, and instruction set; Microcomputer Programming: assembly language, arithmetic operations, decisions, loops, tables, lists, subroutines, and interrupts; Microcomputer Interfacing: input/output modes, serial and parallel interfaces, synchronous and asynchronous communication. Hardware/software interfacing and embedded systems applications.

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

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

Course Learning Outcomes[1]: By the end of this course students will be able to:

1. Solve problems involving conversions between decimal, binary, octal and hexadecimal number systems, signed numbers, arithmetic operations, floating point numbers and representation standards [1]
2. Understand the operation of basic digital systems in the context of microcontroller design including parallel/serial transmission, tri-state logic, clocking, flip-flops and registers, data bus operation [1]
3. Demonstrate knowledge of memory systems including architecture, operation, types, read/write cycles, timing diagrams, applications and techniques to expand word size and capacity [1]
4. Explain the basic operational principles of microprocessors and microcontrollers including architecture, instruction formats, machine language, program and data sections, firmware, step-wise program execution detail and the fetch-decode-execute cycle [1]
5. Design complete and partial address decoding schemes for the microcontroller using memory modules, memory maps, read/write timing and logic components like decoders and tri-state buffers [1]
6. Identify and explain the microcontroller operation from functional block diagrams including: register section, ALU, timing and control, multiplexed buses, pinout, modes of operation and signals [3]
7. Analyze the various types of microcontroller assembly language instructions including addressing modes, processor condition codes, speed of operation and analysis of programs or code segments [3]
8. Outline the operation of an assembler and implement the entire process of writing, compiling, loading and running an assembly language program [3]

9. Illustrate the following concepts and their implementation on the microcontroller: stack operation, interrupt service routines, reset vectors, memory maps, time delay routines [1]
10. Formulate microcontroller input-output solutions utilizing general purpose I/O, interrupts and the timer subsystem [3]
11. List input/output interfacing solutions for issues like voltage mismatch, implementation technology mismatch, power requirements, isolation from electrical loads, and parallel/serial interfacing [1]
12. Implement microcontroller applications using peripherals like the serial interface and the analog-to-digital convertor (ADC) subsystem [3]
13. Incorporate information gained by independent learning from microcontroller technical reference manuals and other sources to implement projects and enhance reports [3]
14. Utilize modern software and hardware tools and techniques to design, debug and test microcontroller based projects using assembly language programming [4]
15. Perform laboratory experiments utilizing microcontroller systems demonstrating combined hardware-software interaction, co-design and debugging [3]
16. Write laboratory reports with experimental results demonstrating visual and written communication skills [3]

[1] *Numbers in brackets refer to method(s) used to evaluate the course objective.*

Relationship to Program Outcomes (Student Learning Outcomes) [2]: This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. have the ability to apply knowledge of the fundamentals of mathematics, science, and engineering; [1, 2, 11]
2. have the ability to use modern engineering tools and techniques in the practice of electrical engineering; [8, 14]
3. have the ability to analyze electrical circuits, devices, and systems; [3, 4, 6, 7, 9]
4. have the ability to design electrical circuits, devices, and systems to meet application requirements; [5, 10]
5. have the ability to design and conduct experiments, and analyze and interpret experimental results; [12, 15]
6. have the ability to identify, formulate, and solve problems in the practice of electrical engineering using appropriate theoretical and experimental methods; [10]
7. have effective written, visual, and oral communication skills; [16]
8. possess an educational background to understand the global context in which engineering is practiced, including:
   a. knowledge of contemporary issues related to science and engineering;
   b. the impact of engineering on society;
   c. the role of ethics in the practice of engineering;
9. have the ability to contribute effectively as members of multi-disciplinary engineering teams;
10. have a recognition of the need for and ability to pursue continued learning throughout their professional careers. [13]

[2] *Numbers in brackets refer to course learning outcome(s) that address the Program 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 grade 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 V. Shirvaikar	Date:	August 8, 2003
Modified By:	Mukul V. Shirvaikar		August 25, 2004 August 20, 2005 January 11, 2010 January 11, 2012 January 4, 2013 December 29, 2014 January 9, 2017 January 7, 2020

The University of Texas at Tyler
Department of Electrical Engineering

EENG 3307: Microprocessors and Embedded Systems
2020 Spring Semester

COURSE OUTLINE

Course Coordinator:

Dr. Mukul V. Shirvaikar, Electrical Engineering
Office: RBN 2014
Phone: 903-565-5620
E-mail: mshirvaikar@uttyler.edu
Website: http://www.uttyler.edu/ee

Class Location/Time:

RBN 2012 / 11:00AM-11:55AM T R
Laboratory RBN 2021 / R 2:00AM-4:45PM

Grading Policy:

Quizzes	25%	A	≥ 90
Mid-Term Exam	25%	B	≥ 80
Laboratory Projects	25%	C	≥ 70
Final Exam	25%	D	≥ 60
Total	**100%**	F	< 60

Note: Students are required to submit all lab reports 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	HOMEWORK
1	13-Jan-2020	**1.** Number Systems and Codes	1.1-1.5; 1.6-1.10	9, 10, 14, 16, 20, 26, 31
2	20-Jan-2020	**2.** Digital Circuits	2.1-2.10; 2.11-2.20	3, 6, 9, 11, 20, 21, 22
3	27-Jan-2020	**3.** Memory Devices	3.1-3.8; 3.9-3.16	1, 13, 15, 18, 27, 39, 40, 46, 55, 57
4	3-Feb-2020	**4.** Introduction to Computers	4.1-4.9; 4.10-4.17	6, 9, 13, 16, 19, 25, 35, 38, 44, 48, 59
5	10-Feb-2020	**5.** Microcomputer Structure and Operation	5.1-5.6; 5.7-5.12	4, 8, 10, 16, 25, 31, 36, 40
6	17-Feb-2020	**6.** The Microprocessor	6.1-6.3; 6.4-6.6	1, 3, 8, 10, 19, 24, 31, 34
7	24-Feb-2020	**7.** Programming the 68HC11 MPU	7.1-7.5; 7.6-7.18	4, 16, 19, 23, 36, 38, 44, 51, 55
8	2-Mar-2020	**Appendix B**: 68HC11 Block Diagram; Midterm Review **MIDTERM EXAM Thursday, Mar.5**	Appendix B	
9	9-Mar-2020	**SPRING BREAK**		
10	16-Mar-2020	**7.** Programming the 68HC11 MPU (contd.)	7.19-7.26	66, 72, 74, 79, 90, 108
11	23-Mar-2020	**Appendix A**: 68HC11 Instruction Set	Appendix A	
12	30-Mar-2020	**Appendix A**: 68HC11 Instruction Set (contd.)	Appendix A	
13	6-Apr-2020	**8.** Input/Output Modes	8.1-8.10	1, 2, 3, 4, 5, 11
14	13-Apr-2020	**8.** Input/Output Modes (contd.)	8.10-8.17	22, 23, 25, 49, 55
15	20-Apr-2020	**9.** Input/Output InterfacingFinal Exam Review	9.1-9.13	1, 4, 8, 11, 16, 34, 41, 49, 52, 61, 63
16	27-Apr-2020	**FINAL EXAM Tuesday, April 28, 11:00AM-1:00PM**		

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.