

University of St. Thomas  
ENGR 330 Design with Microprocessors I

---

<b>Fall 2009</b>	4 Credit Course M,W, F : 10:55 am – 12: 00 pm Room: Owens Science Hall LL54
<b>Instructor</b>	Dr. Ramesh Rajagopalan OSS 104 Phone: 651-962-5414 E-Mail: ramesh@stthomas.edu
<b>Texts</b>	“Introduction to Computing Systems – from bits and gates to C and Beyond” 2 <sup>nd</sup> ed. by Patt and Patel  “Computer Organization and Design” 3 <sup>rd</sup> ed. by Patterson and Hennessey

**Office Hours:** By Appointment

### Course Description

Introduction to computer architecture and assembly language programming. Topics include I/O and memory addressing modes, communication and bus protocols, A/D and D/A conversion, interrupts and common microcontroller peripherals. Tradeoffs between architectures and design approaches will be discussed.

**Prerequisites:** ENGR 230 and CISC 130

### Learning goals

To understand the structure and function of computing systems, the choices available in the design of a microprocessor based system and the relationships between problem requirements and design choices in this area.

### Course Outcomes for ENGR 330 (Codes in parentheses refer to program outcomes)

Upon successful completion of the course, the student will be able to:

1. Explain common numeric formats and other commonly used encoding schemes and choose appropriate formats for applications (a),

## ENGR 330 — Microprocessors I

2. Explain the general organization of a computer system and the principles upon which computers are based (a),
3. Describe the varieties of microprocessors and microcontrollers currently available and how they differ (a, e),
4. Explain typical assembly language instructions and addressing modes (a),
5. Explain how a program in a high level language is translated and executed (a),
6. Explain the roles of an operating system and how a processor design can support those roles (a),
7. Explain how the components of a computer are constructed from digital logic (a),
8. Read data sheets and other specifications of a processor to determine its strengths and weaknesses and present this information clearly to others (b, e, g, k)
9. Select an appropriate microprocessor for an application and justify that selection in terms of speed, functionality, and cost (e, c, k),
10. Select appropriate representations for data in an application (e),
11. Determine the requirements for a microprocessor based on a set of application requirements (c, k).

### Course methodology

This class will use blackboard. Lectures, assignments, and course announcements will be posted on blackboard. Please check blackboard at least once a day for class communications.

### Course objectives

- Gaining factual knowledge (terminology, classification, methods, trends)
- Learning fundamental principles, generalizations, and theories
- Learning to apply course material (to improve thinking, problem solving, and decisions)
- Developing skill in expressing myself orally or in writing

### Tentative Schedule (subject to change):

Date	Topic	Chapter	Exam
09/09	Introduction and digital review	1	
09/11	Computer arithmetic	2, P&H 3	
09/14	Computer arithmetic	2, P&H 3	
09/16	The Von Neumann model and the LC-3 example	4, P&H 5	
09/18	The Von Neumann model and the LC-3 example	4, P&H 5	
09/21	The LC-3 instruction set architecture	5	
09/23	Programming	6	
09/25	Assembly language	7	

**ENGR 330 — Microprocessors I**

09/28	Assembly language	7	
09/30			Exam1
10/2	Input/output and interrupts	8	
10/5	Input/output and interrupts	8	
10/7	Subroutines and stack	9,10	
10/9	Subroutines and stack	9, 10	
10/12	Architecture review	P&H 1,2	
10/14	Architecture review	P&H 1,2	
10/16	Intro to C	11	
10/19	Variables and operators	12	
10/21	Structures	13	
10/23	Functions	14	
10/26	Testing and debugging	15	
10/28			Midterm
10/31	Midterm break		
11/2	Pointers and arrays	16	
11/4	Pointers and arrays	16	
11/6	Recursion	17	
11/9	I/O	18	
11/11	Data structures	19	
11/13	Data structures	19	
11/16	Overview of performance criteria and means of enhancement	P&H 4	
11/18	RISC, CISC, DSP	P&H D	
11/20	Memory hierarchy and cache	P&H 7	
11/23	Secondary storage devices/ virtual memory	P&H 8	
11/25	Secondary storage devices/ virtual memory	P&H 8	
11/26	Thanksgiving break		
11/30	Vector processors and pipelining	P&H 6	
12/2	Vector processors and pipelining	P&H 6	Draft papers due
12/4	Student presentations		
12/7	Student presentations		
12/9	Review		
12/11	Review		

**Grading policy:**

1. The final grade will be based on:

- Assignments: 10%
- Exam1: 20 %
- Midterm: 25%
- Project (reports and presentation): 15%
- Final exam: 30%

2. **The entire course will be graded on a curve.** Hence your final course grade is determined based on the final distribution of all grades in the class, not on any specific grade cut-off. When grading on a curve, the absolute score is not that important. **Don't be upset if you don't get what you consider to be a high score.** To give you a feeling about where you stand, statistics about the scores will be provided periodically. I assign the final grades using the following guidelines. We utilize a plus/minus grading system.

A	Achievement that is outstanding and well above the level necessary to meet course objectives
B	Achievement that is above the level necessary to meet course objectives
C	Achievement that meets the basic course objectives
D	Achievement that is worthy of credit even though it does not fully meet the course objectives
F	Achievement that fails to satisfy the basic course objectives

**Exam dates:**

- Exam 1: 9/30
- Midterm: 10/28
- Final exam: 12/15; 10:30 am -12:30 pm

**Makeup policy**

There will be no make up for assignments. For exams, **make up may be granted only for a medical emergency.** The student should inform the instructor well in advance and provide appropriate documentation from a physician. There are no exceptions to this policy. **Make up exams will not be granted for any other scenarios such as scheduled interviews or business trips.**

**Academic Integrity:** All students are expected to understand and follow University of St. Thomas policies on Academic Integrity. These are described at:  
[www.stthomas.edu/policies/student\\_policy\\_book/Academic\\_rights\\_and\\_procedures.htm](http://www.stthomas.edu/policies/student_policy_book/Academic_rights_and_procedures.htm)

**Attendance:** Students are encouraged to attend all class sessions. If you cannot attend a lecture or two, its fine. If a special situation arises and you need to miss more than two lectures, contact me.

**Disability accommodation:** Qualified students with documented disabilities who may need classroom accommodations should make an appointment as soon as possible with the Enhancement Program – Disability Services office. Appointments can be made by calling 651-962-6315. You may also make an appointment in person in O’Shaughnessy Educational Center, room 119. For further information, you can locate the Enhancement Program on the web at <http://www.stthomas.edu/enhancementprog/>

### **2009 - 2010 Syllabus Statement Related to Influenza:**

The University of St. Thomas is committed to a healthy campus community. During the 2009-2010 academic year, there will be ongoing concerns regarding the prevalence among university faculty, staff and students of both the H1N1 virus and seasonal influenza. To help limit the spread of these illnesses, the Centers for Disease Control has provided college campuses the following recommendation: students, faculty, or staff with influenza like illnesses (temperature of 100.0 or greater, plus a cough or sore throat) are directed to self-isolate (or stay home) for at least 24 hours after their fever is gone without the use of fever-reducing medicine. In the event that students are unable to attend classes due to this self-isolation recommendation, they should consult the university’s pandemic web site <http://www.stthomas.edu/pandemic/plan/default.html> and complete an on-line form informing professors of their absence. In accordance, faculty will provide opportunities for these students to participate in alternative educational delivery due to this illness.