Course Title: Microprocessor Systems  
Course Number: ECE-411  
Term:  
Credit hrs: 3  
Instructor:  
Office:  
Office Hours:  
Prerequisites: ECE 321 Digital Systems  
Meeting Time:  
Location:  
Email:  
Extension:  

I. Course Description (as in the University Bulletin):  
Microprocessor architecture and organization, Bus architectures, types and buffering techniques, Memory and I/O subsystems, organization, timing and interfacing, Peripheral controllers and programming. Practice of the design of a microprocessor system.

Prerequisite: ECE 321 Digital Systems

II. Required Text/Materials:  
An Introduction to the Intel Family of Microprocessors  

The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, and Pentium Pro Processor Architecture, Programming, and Interfacing  

III. Student Learning Outcomes:

<table>
<thead>
<tr>
<th>Course SLO</th>
<th>Program Student Learning Outcome PSLOs</th>
<th>Institutional Learning Outcome ILOs</th>
<th>Direct and Indirect Assessment Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLO 1: Explain how the hardware and software components of a microprocessor-based system work together to implement system-level features;</td>
<td>PSLO 1, 2, 3 &amp; 5</td>
<td>ILO 2 &amp; 5</td>
<td>1, 2 &amp; 3</td>
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<tr>
<td>SLO 2: Describe both hardware and software aspects of integrating digital devices (such as memory and I/O interfaces) into microprocessor-based systems</td>
<td>PSLO 1, 2, 3 &amp; 5</td>
<td>ILO 2 &amp; 5</td>
<td>1, 2 &amp; 3</td>
</tr>
<tr>
<td>SLO 3: Describe the operating principles of, and gain hands-on experience with, common microprocessor peripherals such as UARTs, timers, and analog-</td>
<td>PSLO 1, 2, 3 &amp; 5</td>
<td>ILO 2 &amp; 5</td>
<td>1, 2 &amp; 3</td>
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</tbody>
</table>
to-digital and digital-to-analog converters

| SLO 4: Identify practical applications of digital logic design and assembly-language programming | PSLO 1, 2, 3 & 5 | ILO 2 & 5 | 1, 2 & 3 |
| SLO 5: Identify and analyze the tools and techniques used to design, implement, and debug microprocessor-based systems (during the Lab) | PSLO 1, 2, 3 & 5 | ILO 2 & 5 | 1, 2 & 3 |

**PROGRAM STUDENT LEARNING OUTCOMES**

- **PSLO 1:** Apply knowledge of mathematics, science, and applied sciences
- **PSLO 2:** Design and conduct experiments, as well as to analyze and interpret data
- **PSLO 3:** Formulate or design a system, process, or program to meet desired needs
- **PSLO 5:** Identify and solve applied science and engineering problems

**ASSESSMENT MEASURES**

**Direct Assessment Method:**
1) SLO specific Embedded Questions in Selected Homework
2) SLO specific Embedded Questions in Tests and Final Exam
3) Rubric evaluation of Projects and/or Portfolios

**Indirect Assessment Method:**
1) Course Letter Grades

**IV. Schedule of Learning Opportunities (assignments):**

**(WEEK 1-2)**
80x86 Processor Architecture: Introduction, Processor Model, Programmer’s model, Designer’s Model: 8086 hardware details, Clock generator 8284A, Bus buffering and latching, Processor Read & Write bus cycles, Ready and wait state generation, Minimum versus Maximum mode operation.

**(WEEK 3-4)**
Memory Interfacing: 80x86 processor-Memory interfacing, Address decoding techniques, Memory Devices – ROM, EPROM, SRAM, FLASH, DRAM devices, Memory internal organization, Memory read and write timing diagrams, DRAM Controller

**(WEEK 5-6)**
Basic I/O Interfacing: Parallel I/O, Programmed I/O, I/O port address decoding, The 8255A Programmable Peripheral Interface(PPI), programming 8255,
Operation modes, Interface examples – Keyboard matrix, LCD/7-Segment Display, Printer, stepper motor, A/D and D/A converter.

(WEEK 7-8)
Timer Interfacing: The 8254 Programmable Interval Timer(PIT), Timing applications.

(WEEK 9-10)

(WEEK 11-12)
Interrupts : Interrupt driven I/O, Software & Hardware interrupts, Interrupt vectors and vector table, Interrupt processing, The 8259A Programmable Interrupt Controller(PIC)- cascading of 8259s, programming 8259, Interrupt examples – Printer, Real-Time Clock, PC Keyboard.

(WEEK 13-14)
Direct Memory Access : Basic DMA operation, DMA Controlled I/O, The 8237 DMA Controller, Disk Memory Systems- Floppy disk, Hard disk, optical disk memory systems, video displays.

(WEEK 15)
Bus Interfaces: PC bus standards & interfaces – PCI, USB, Firewire, AGP

COMPUTER PROJECTS:

Projects will be given based on material covered in class. The students are encouraged to make regular visits during office hours, to meet in study groups, and to use the Tutors (if available).

Late Work and Make-Ups

All projects, assignments, and exams must be completed by the scheduled date. Late assignments or make-up tests or quizzes will only be allowed with official documentation and grades may be lowered. To qualify for a make-up, a student must have notified the professor and rescheduled in a timely manner.

V. Calculation of Final Grades:
Tests ............................................................................................................................................................ 80%
Assignments and Projects .......................................................................................................................... 20%

The final score will be calculated based on the scores earned on tests, projects, assignments, and in-class work listed below using a weighted average formula shown. The Final letter grade will be awarded using the grading scale guideline shown.
FINAL SCORE = \((\text{Test Points Earned})/(\text{Total Test Points}) \times 80 + (\text{Assignments and Projects Points Earned})/(\text{Total Assignments and Projects Points}) \times 20\)

- Grading & SLO Rubrics

<table>
<thead>
<tr>
<th>Scale</th>
<th>Criteria</th>
<th>SLO Rubric</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 – Excellent</td>
<td>Response to each component of the problem is complete and accurate. All instructions followed completely.</td>
<td></td>
</tr>
<tr>
<td>3 – Very Good</td>
<td>Response to each component of the problem is complete and accurate. All instructions followed completely. Some errors were made</td>
<td>Proficient</td>
</tr>
<tr>
<td>2 – Good (or Satisfactory)</td>
<td>Response to most but not all components of the problem is complete. Some errors were made</td>
<td></td>
</tr>
<tr>
<td>1 – Fair (or Needs Improvement)</td>
<td>Response to all components of the problem only partially correct.</td>
<td>Not Proficient</td>
</tr>
<tr>
<td>0 – Poor (or Unacceptable)</td>
<td>Response unrelated to all components of the problem. Nothing is correct.</td>
<td></td>
</tr>
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</table>

The grading scale guideline:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>92-100%</td>
</tr>
<tr>
<td>A-</td>
<td>88-91%</td>
</tr>
<tr>
<td>B+</td>
<td>85-87%</td>
</tr>
<tr>
<td>B</td>
<td>82-84%</td>
</tr>
<tr>
<td>B-</td>
<td>78-81%</td>
</tr>
<tr>
<td>C+</td>
<td>75-77%</td>
</tr>
<tr>
<td>C</td>
<td>72-74%</td>
</tr>
<tr>
<td>C-</td>
<td>68-71%</td>
</tr>
<tr>
<td>D+</td>
<td>65-67%</td>
</tr>
<tr>
<td>D</td>
<td>58-64%</td>
</tr>
<tr>
<td>F</td>
<td>0-57%</td>
</tr>
</tbody>
</table>

VI. Attendance Policy:
The Lincoln University uses the class method of teaching, which assumes that each student has something to contribute and something to gain by attending class. It further
assumes that there is much more instruction absorbed in the classroom than can be tested on examinations. Therefore, students are expected to attend all regularly scheduled class meetings and should exhibit good faith in this regard. For the control of absences, the faculty adopted the following regulations:

- **Four** absences may result in an automatic failure in the course.
- **Three** tardy arrivals may be counted as one absence.
- Absences will be counted starting with whatever day is specified by the instructor but not later than the deadline for adding or dropping courses.

In case of illness, death in the family, or other extenuating circumstances, the student must present documented evidence of inability to attend classes to the Vice President for Student Affairs and Enrollment Management. However, in such cases, the student is responsible for all work missed during those absences.

Students representing the University in athletic events or other University sanctioned activities will be excused from class(es) with the responsibility of making up all work and examinations. The responsible office will issue the excuse note to the instructor.

**VII. Students with Disabilities Statement:**
The Lincoln University is committed to non-discrimination of students with disabilities and therefore ensures that they have equal access to higher education, programs, activities, and services in order to achieve full participation and integration into the University. In keeping with the philosophies of the mission and vision of the University, the Office of Student Support Services, through the Services for Students with Disabilities (SSD) Program, provides an array of support services and reasonable accommodations for students with special needs and/or disabilities as defined by Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990. The Services for Students with Disabilities Program seeks to promote awareness and a campus environment in which accommodating students with special needs and/or disabilities is a natural extension of the University’s goal.

**VIII. University Academic Integrity Statement:**
**Responsibility and Standards**
Students are responsible for proper conduct and integrity in all of their scholastic work. They must follow a professor’s instruction when completing tests, homework, and laboratory reports, and they must ask for clarification if the instructions are not clear. In general, students should not give or receive aid with taking exams, or exceed the time limitations specified by the professor. In seeking the truth, in learning to think critically, and in preparing for a life of constructive service, honesty is imperative. Honesty in the classroom and in the preparation of constructive service, honesty is imperative. Honesty in the classroom and in the preparation of papers is, therefore, expected of all students. Each student has the responsibility to submit work that is uniquely his or her own. All of this work must be done in accordance with established principles of academic integrity.

**Acts of Academic Dishonesty (Cheating)**
Academic Dishonesty includes, but is not limited to:

- Copying, offering and/or receiving unauthorized assistance or information in examinations, tests, quizzes; in the writing of reports, assigned papers, or special assignments, as in computer programming; and in the preparation of creative works (i.e. music, studio work, art).
- The fabrication or falsification of data, results, or sources for papers or reports.
- The use of unauthorized materials and/or persons during testing.
- The unauthorized possession of tests or examinations.
- The physical theft, duplication, unauthorized distribution, use or sale of tests, examinations, papers, or computer programs.
- Any action that destroys or alters the work of another student.
- Tampering with grades, grade books or otherwise attempting to alter grades assigned by the instructor.
- The multiple submission of the same paper or report for assignments in more than one course without the prior written permission of each instructor.

Plagiarism

If a student represents “another person’s ideas or scholarship as his/her own,” that student is committing an act of plagiarism. The most common form of plagiarism among college students is the unintentional use of others’ published ideas in their own work and representing these ideas as their own by neglecting to acknowledge the sources of such materials. Students are expected to cite all sources used in the preparation of written work, including examinations.

It is each student’s responsibility to find out exactly what each of his/her professors expects in terms of acknowledging sources of information on papers, exams, and assignments. It is the responsibility of each faculty person to state clearly in the syllabus for the course all expectations pertaining to academic integrity and plagiarism. Sanctions peculiar to the course should also be explained in the syllabus.

Sanctions

Sanctions for violations of the academic integrity standards include:

- Warning: A written notice that repetitions of misconduct will result in more severe disciplinary action. The warning becomes part of the student’s file in the Office of the Registrar and, if there is no other example of misconduct, is removed at the time of graduation.
- Failure for Project (exam, paper, experiment).
- Failure of Course (students may not drop or withdraw from the course after being informed of the charge of academic dishonesty).

The sanction for a first offense may be either a Warning or Failure for Project. The sanction for any additional offenses may be either a Failure for Project or a Failure of Course. For serious and repeat offenses, the University reserves the right to suspend or expel a student.

Appeals of Charges of Academic Dishonesty
The student may appeal a charge of academic dishonesty within ten days of receiving notice of same. The appeal will be heard by the Juridical Review Committee. Files on violations of this academic integrity code will be kept in the Office of the Registrar.

**Disorderly Conduct**
Behavior that disrupts the academic pursuits, substantially injures the academic reputation, or infringes upon the privacy, rights, or privileges of other persons is prohibited.

**Respectful Conduct**
- It is expected of all students to show respect, fairness and consideration.
- Arrive for class on time. Late class arrivals are disruptive and inconsiderate. Students who frequently arrive late may be asked not to return to class.
- Stay for the entire class. If you must leave early (for a valid reason), do so without causing a disruption. Sit near the exit and inform the instructor in advance if you must leave.
- Set on silent/vibrate mode: cell phones, pagers, iPods or other electronic devices not required for class. Use of cell phones, texting or checking messages is prohibited and the penalty of **5 points** will be deducted from the score of your next test. This rule will apply every time this happens.

**Note:**
The instructor of a given section of the course may make some modifications to the evaluation as well as to the rest of the syllabi including but not limited to: the grade weights, number of tests, and test total points.