Application of computer hardware and software solutions to industrial production and control problems.

OVERVIEW

Course Overview: A study of principles of programming and applications of digital computers in the solution of a wide variety of industrial design, management, and production control problem areas. Students will develop a working knowledge of the C programming language in laboratory exercises. Students will also develop a working knowledge of Electronic components, circuits and troubleshooting techniques. This knowledge will be employed by managing interface devices.

STUDENT OUTCOMES

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

1. Identify major electronic components, their characteristics, and their function in electronic circuits.

2. Identify major programming commands (C) and analyze how these programming commands function.

3. Develop algorithms and programs to solve scenarios.

4. Solve a variety of industrial design, management, and production control problems using C programming techniques to modify source code.
5. **Solve** a variety of industrial design, management, and production control problems by utilizing, creating or modifying hardware interface devices.

6. **Analyze** computer interface problems and synthesize possible hardware and/or software solutions.

7. **Develop** the specifications for software appropriate to a given specification.

8. **Develop** the specifications for circuitry appropriate to a given situation.

**COURSE TOPICAL OUTLINE**

I. Introduction to Circuit Theory  
   A. Basic Components  
      B. Laws/Theorems for Circuit Analysis  
      C. Passive Electronic Components  
      D. Transistors  
      E. Using electronic equipment in the lab

II. Introduction to C Programming Language  
   A. Constants, Variable types and Declarations  
   B. Operators  
      1. Math Operators  
      2. Relational Operators  
      3. Logical Operators  
      4. Conditional Operators  
         I. Nested Ifs  
         II. Switch  
   C. Looping  
      1. While Loop  
      2. Do-While Loop  
      3. For Loop  
   D. Arrays and Strings  

III. Advanced Techniques  
   A. Functions  
   B. Pointers  
   C. I/O  
   D. Object Oriented Design
IV. Embedded Systems Applications
   A. Introduction to Raspberry Pi
   B. Understanding Raspberry Pi Operating Systems
   C. Construction of Circuits using Pi
   D. Raspberry Pi Communicating with Arduino

V. Micro-Controller Fundamentals
   A. Arduino Micro-controller
   B. Architecture and Features
   C. Applications
   D. Construct circuits using Arduino

VI. Microprocessor interfacing using Arduino
   A. Fundamentals
   B. Problems

B.5 BIBLIOGRAPHY

REQUIRED TEXT

REFERENCE TEXTS

REFERENCE MATERIALS
Supplementary course material will be published on the Student Share.

STUDENT TASKS

REQUIRED TASKS:

TEC 284 activities are primarily designed to provide the information and practical experience for the management of computers and industrial interface devices. The TEC computer lab provides access to electronic interface devices and the freedom to experiment with them.
The laboratory exercises initially provide structured activities to develop the student’s understanding with this equipment. The laboratory exercises will then employ both the software skills and equipment in solving scenarios and troubleshooting.

**Classroom and lab activities –**

Students will:
- Identify C commands and specifications
- Construct C programs to solve scenarios.
- Identify hardware interface devices and specifications.
- Utilize, create or modify hardware interface devices.
- Modify source code to solve interface problems
- Develop hardware and software computer interfaces with safety and accuracy

**Laboratory Attendance –**

- 5% is deducted for each documented unexplained absence out of a possible 100%.

**Laboratory Assignments –**

Students will:
- Complete assigned tasks (i.e. assignments, reading, c programs…)
- Prepare C programs solving specific scenarios and apply the concepts learned.
- Answer questions, perform subsequent analysis as needed for laboratory exercises
- Questions/Further work from labs will be due (1) one week after lab execution

**Take Home Assignments –** Students will be given (2) two weeks to complete these assignments

**Tests –**

Students will take:
- Take Home Assignments
- Quizzes ( Highest 4 score average out of 5 possible quiz scores )
- Midterm Exam
- Final Practical & Exam

**RULES**

- Programs that are submitted (where needed for labs/assignments) which do not compile will be given a score of (0) zero.

**Ask Questions**

- If you do not understand something that is being taught in class, please ask questions. If you are uncomfortable asking your question before the group, please feel free to send me an email and I will respond. Asking questions in class benefits everyone!

**Absenteeism**

- Notify me as soon as possible if you know you will be absent from a class, especially if it is a lab.

**Collaboration and Plagiarism**

- Students may discuss assignment related work. However students must work on assignments independently and all work submitted must be only the work of the student whose name appears on the submitted assignment. For lab exercises, you may be required to pair-up with a partner. In those cases you may work together, otherwise you will have to work individually. Although when working in a group, measurements and constructing circuits are done as a team, the final lab write up MUST BE DONE individually with no collaboration. I have a
ZERO TOLERANCE policy for cheating and dishonesty. Any offense will result in you failing the class and being reported to the relevant academic authorities.

**EVALUATION**

The final course grade will be based on the student's attendance and performance in classroom and lab activities, assignments, quizzes and tests.

**Grading Weights**

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Class Participation</td>
<td>5%</td>
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<tr>
<td>Take Home Assignments</td>
<td>20%</td>
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<tr>
<td>Laboratory Work/Assignments</td>
<td>20%</td>
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<tr>
<td>Quizzes (Top 4 out of 5)</td>
<td>20%</td>
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<tr>
<td>Midterm Exam</td>
<td>15%</td>
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<tr>
<td>Final Practical &amp; Exam</td>
<td>20%</td>
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**Grading Scale**

<table>
<thead>
<tr>
<th>Assignment of Grades</th>
<th>100 - 90%</th>
<th>89 - 80%</th>
<th>79 - 70%</th>
<th>69 - 60%</th>
<th>59 &amp; below</th>
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<tr>
<td></td>
<td>A</td>
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<td>D</td>
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Any student needing to arrange a reasonable accommodation for a documented disability should contact Disability Concerns at 350 Fell Hall, 309-438-5853, www.disabilityconcerns.ilstu.edu.

**Absences due to Student Bereavement.** Students who experience the death of an immediate family member or relative as defined in the University Student Bereavement Policy will be excused from class for funeral leave, subsequent bereavement, and/or travel considerations. Students are responsible for providing appropriate documentation to the Dean of Students office and for contacting the instructor as soon as possible to make arrangements for completing missed work. More information is available in the Student Bereavement Policy at [http://www.policy.illinoisstate.edu/2-1-27.shtml](http://www.policy.illinoisstate.edu/2-1-27.shtml)