Beni Suef Technological University

Fundamentals of PC-based Control

Syllabus

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Course Title: Fundamentals of PC-based Control

Course Code: N/A

Course Followers:

Students of Mechatronics Department in 1st semester of 2nd year

Course Meeting Times

Lectures: 1 session / week, 2 hours / session

Labs: 1 session / week, 4 hours / session

Course Credits: 3

Course Introduction

This unit deals with some fundamentals of PC-based control systems which are more and more necessary for Mechatronics technicians. The main contents include: Basic structure of the program under the Visual C/C++ environment, Variables & Functions, Basic IoT structure, Selective processing, linking the program with IoT, Industry case study programs, Practice Arrays, Program industrial cases.

Course Objectives

After successfully studying this course, students will have to:

1. Familiarize to C language programming
2. Training on different data types, variables and operators
3. Familiarize to main laboratory functions on C language
4. Understand the development tools and debugging equipment for the determined microprocessor.
5. Understand the structure of the firmware exercise equipment.
6. Familiarize to main laboratory instruments
7. Improve the programmability of peripherals.
8. Use the software library according to the developed development environment.
9. Explain what type of a program MPS-Lab is and where it is used.
10. Explain the basic functions required for the use of MPS-Lab in detail.
11. Explain the methods of composing circuits for simulation
12. Explains the method of drawing various geometric shapes for easy understanding or inserting comments within the circuit diagram of MPS-Lab.
13. Describes the various basic functions needed in performing simulations
14. Applying practical project after studying the course

Learning Outcomes

After successfully studying this course, students will be able to:

1. Familiarizing to the C language fundamentals
2. Identify the basic syntax, data types and variables on C Language programming
3. Build a simple code with C language programming to practice on operators and decision making.
4. Build a simple code with C language programming to practice on Loops
5. Design a simple functions on C language and calling it.
6. Implement LED Control Firmware
7. Implement Buzzer Control Firmware
8. Implement Switch Control
9. Implement FND Control Firmware
10. Implement Digital I/O Control Firmware
11. Learn the functions of MPS-Lab
12. Learn how to draw circuits
13. Use Various Functions of the Simulation and Draw on the Circuit Diagram

Prerequisites

C – Programming language

Application of Math and Science in Technology

Physics for Technicians

Electric circuits

Textbooks

The course textbooks are:

1. Allan R. Hambley, Electrical Engineering Principles and Applications (5th edition), Pearson, 2011, New York. ISBN-13: 978-0-13-215516-8
2. Greg Perry and Dean Miller, C Programming Absolute Beginners Guide (3rd edition), Absolute Beginners Guide Series, Que Publishing Company, 2013, USA. ISBN-13: 978-0-7897-5198-0
3. Wael Z. Tawfik, Fundamentals of PC-based Control (Practice Manual), BST, 2020.

Homework

- Homework will be issued in lectures and collected a week later in recitation.
- Corrected homework with solutions will be returned in labs the week after it is collected. You are welcome and encouraged to discuss the homework among your colleagues. However, the final formulation and write up of your homework answers must be your own.
- Submitting homework copied from someone else is a breach of ethics, and will be handled by the Committee on Discipline. More importantly, although homework counts for only 5 percent of the grade, they are critical to learning the material and to doing well on the quizzes and final exam. **One homework problem will appear in each of the tests**, and homework performance will be taken into account during grade assignment for cases that are on letter-grade boundaries.
- **Late homework will not be accepted for grading**. However, total homework grades will be based on the best nine out of eleven individual homework grades. Thus, with one exception, two homework assignments may be missed without a grading penalty.
- All homework will be graded on a coarse scale of 0 to 3 points. 3 points if all or nearly all problems are correct, 2 points if homework is approximately half correct, 1 point if mostly incorrect, and 0 points if late or not submitted.

Labs (or Tutorials/Exercise, Workshop)

- Labs will be conducted during the weeks shown in the schedule. Each lab assignment involves one or more accomplishments which must be checked off by an instructor in the lab. The instructor will be available for help and lab check-off during those weeks in which a lab is in progress.
- No written work will be due for the last lab.
- Students are welcome and encouraged to discuss the labs among your colleagues. You are also welcome to team up in pairs to execute a lab. However, the write up of your lab must be done on your own. Skipping the lab and submitting work copied from someone else is a serious breach of ethics, and will be handled by the Committee on Discipline.
- Lab assignments will be graded on a scale of 0 to 3 (3: lab complete, works, good job on pre- and post-lab; 2: lab mostly complete, reasonable job on pre and post lab; 1: lab partially done, marginal to poor job on pre- and post-lab; 0: lab not done, poor job on pre- and post-lab).

Lab Books

- You must obtain the contents of a few pages for every lab (from Lab #1 to lab #15) for recording measurements, observations and graphs of data taken during the in-lab exercises.
- Written pre-lab and post-lab exercises are also to be completed in your own papers.

Midterm Exam

- One closed-book midterm exam will be given in this term. The exam will take place few days after Lab #7 for a two-hour duration.
- There will be no lecture or lab on the day. **You may bring one two-sided sheet of notes written by your own hands to the exam**. You may also bring a calculator, eraser, pencil or ball pens.

Final Exam

- A three-hour final exam will be given during the end-of-term exam week. Timing and room assignments will be announced later. **You may bring three two-sided sheets of notes written by your own hands to the exam**.

Calendar

The calendar provides information on the course's lecture class (L), lab (Lab #), and exam (E) sessions.

SES #	TOPICS	KEY DATES
L1	Introduction to C language Programming	Homework #1 in
Lab #1	Basic Syntax, Data Types, Variables, Constants And Literals	Lab report #1 in
L2	Basic operators and Decision making on C language	Homework #1 out Homework #2 in
Lab #2	Operators and Decision Making	Lab report #1 out Lab report #2 in
L3	Loops on C Language	Homework #2 out Homework #3 in
Lab #3	Loops	Lab report #2 out Lab report #3 in
L4	Functions on C language	Homework #3 out Homework #4 in
Lab #4	Functions	Lab report #3 out Lab report #4 in
L5	Introduction to IOT	Homework #4 out Homework #5 in
Lab #5	Identify Development Tools	Lab report #4 out Lab report #5 in
L6	Digital I/O Control	Homework #5 out Homework #6 in
Lab #6	Utilization of Software Library and Implement Digital I/O Control Firmware	Lab report #5 out Lab report #6 in
L7	LED Control	

SES #	TOPICS	KEY DATES
Lab #7	Implement LED Control Firmware	Lab report #6 out Lab report #7 in
E1	**Midterm Exam**	
L8	Buzzer Control	
Lab #8	Implement Buzzer Control Firmware	Lab report #7 out Lab report #8 in
L9	Switch Control	
Lab #9	Implement Switch Control	Lab report #8 out Lab report #9 in
L10	FND Control	
Lab #10	Implement FND Control Firmware	Lab report #9 out Lab report #10 in
L11	Introduction to MPS - Lab	Homework #10 out Homework #11 in
Lab #11	Introduction to MPS-Lab and Installation Environment	Lab report #10 out Lab report #11 in
L12	Functions of MPS-Lab	Homework #11 out Homework #12 in
Lab #12	Functions of MPS-Lab	Lab report #11 out Lab report #12 in
L13	Design Circuits on MPS- Lab	Homework #12 out Homework #13 in
Lab #13	Drawing Circuits	Lab report #12 out Lab report #13 in
E2	**Final Exam**	

Grading (or Assessment) Policy

Initial grading will be based on the following weighting:

ACTIVITIES	PERCENTAGES
Homework	5%
Labs (performance & reports)	35%
Midterm	30%
Final exam	30%

- Lab assignments will be graded on a scale of 0 to 3
  - i) 3: lab complete, works, good job on pre- and post-lab;
  - ii) 2: lab mostly complete, reasonable job on pre and post lab;
  - iii) 1: lab partially done, marginal to poor job on pre- and post-lab;
  - iv) 0: lab not done, poor job on pre- and post-lab.
- All homework will be graded on a coarse scale of 0 to 3 points,
  - i) 3 points if all or nearly all problems are correct,
  - ii) 2 points if homework is approximately half correct,
  - iii) 1 point if mostly incorrect, and
  - iv) 0 points if late or not submitted.

· This will be followed by considerable discussion among the entire teaching staff to factor in your diligence on the homework and labs, and your participation in class and labs. This discussion can affect your letter grade for the course, particularly if your initial grade is on a letter-grade boundary.

· Furthermore, failure to complete the labs in this subject will result in an overall grade that is one letter grade lower (not an Incomplete).

· This subject has been designed so that lectures, homework and labs are integral and essential parts of the learning process. Although there is no specific reward for participation, there is a clearly defined penalty for not participating. Students who consistently miss lectures, homework and labs will not be included in the grading discussions.

Lecture notes

This section contains lecture notes from some chapters of the following books,

1. Allan R. Hambley, Electrical Engineering Principles and Applications (5th edition), Pearson, 2011, New York. ISBN-13: 978-0-13-215516-8
2. Greg Perry and Dean Miller, C Programming Absolute Beginners Guide (3rd edition), Absolute Beginners Guide Series, Que Publishing Company, 2013, USA. ISBN-13: 978-0-7897-5198-0

LEC #	TOPICS	LECTURE NOTES (BOOK I FOR L5 TO L13 & BOOK II FOR L1 TO L4)
L1	Introduction to C language Programming	Chapter I
L2	Basic operators and Decision making on C language	Chapter II
L3	Loops on C Language	Chapter III
L4	Functions on C Language	Chapter V
L5	Introduction to IOT	Chapter 2:
L6	Digital I/O Control	Chapter 2:
L7	LED Control	Chapter 4: Application
L8	BUZZER Control	Chapter 4: Application
L9	Switch Control	Chapter 4: Application
L10	FND Control	Chapter 4: Application
L11	Introduction to MPS - Lab	Chapter 6
L12	Functions of MPS-Lab	Chapter 6
L13	Design Circuits on MPS- Lab	Chapter 6

Lab notes (or Practice Manual)

This section contains lab notes from every chapter of the practice manual, "Wael Zakaria Tawfik, Fundamentals of PC-based Control (Practice Manual), (Practice Manual), 2020."

LAB #	TOPICS	LAB NOTES (PRACTICE MANUAL CHAPTER)
Lab #1	Basic Syntax, Data Types, Variables, Constants And Literals	Module 1 Chapter 1
Lab #2	Operators and Decision Making	Module 1 Chapter 2
Lab #3	Loops	Module 1 Chapter 3
Lab #4	Functions	Module 1 Chapter 4
Lab #5	Identify Development Tools	Module 2 Chapter 1
Lab #6	Utilization of Software Library and Implement Digital I/O Control Firmware	Module 2 Chapter 2
Lab #7	Implement LED Control Firmware	Module 2 Chapter 3
Lab #8	Implement Buzzer Control Firmware	Module 2 Chapter 4
Lab #9	Implement Switch Control	Module 2 Chapter 5
Lab #10	Implement FND Control Firmware	Module 2 Chapter 6
Lab #11	Introduction to MPS-Lab and Installation Environment	Module 3 Chapter 1
Lab #12	Functions of MPS-Lab	Module 3 Chapter 2