NEW YORK CITY COLLEGE OF TECHNOLOGY

Electromechanical Engineering Technology | Course Outline

Course: CET 2411: C/C++ Programming for Embedded Systems
Course Coordinator: Prof. Xiaohai Li, PhD. **Revised on:** November, 2024
Credits: 3 **This course is:** ☐Required ☒Elective ☐Selective Elective
Contact Hours: 4 **Class Hours:** 2 **Lab Hours:** 2 **Ind. Study Hours:** 0 **Internship Hours:** 0

Catalogue Description:
Introduction to the basics of C/ C++ programming language with applications to embedded systems. Fundamentals of structured and object-oriented programming in C/C++ and their applications in hardware environments. Students develop projects that highlight the application of C/C++ language in an embedded system.

Prerequisites: None

Pre or Corequisites: CET 2370 or department approval; EET 2262 or TCET 2242 or ENT 2280 or MTEC 2280 or MECH 1240

Required Texts [Title. Authors. Publisher. Year.]
1. No required textbook.

Other Suggested References or Supplemented Material
1. Programming Embedded Systems in C and C++, 2nd Edition, Michael Barr and Anthony Massa, O'Reilly, ISBN-10: 0596009836, ISBN-13: 978-0596009830, 2006.
2. C++ Primer Plus, 6th Edition, Stephen Prata, Addison-Wesley Professional, ISBN-10: 0321776402, ISBN-13: 978-0321776402, 2011.
3. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers, 2nd Edition, Tammy Noergaard, Newnes, ISBN-10: 0123821967, ISBN-13: 978-0123821966, 2010.
4. C++ for embedded systems, Arkady Miasnikov, ASIN : B00WVDHP8E, April, 2015

Course Learning Outcomes

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

1. Demonstrate basic knowledge of structured programming in C/C++.
2. Demonstrate understanding of the fundamentals of object-oriented programming in C++.
3. Demonstrate knowledge of using basic hardware and software tools for C/C++ program development in a hardware environment.
4. Demonstrate basic knowledge of developing C/C++ programs for basic external hardware devices.
5. Demonstrate basic knowledge and skills on embedded system development by integrating C/C++ programs with hardware devices.

General Education Outcomes

KNOWLEDGE/Depth of Knowledge: Engage in an in-depth, focused, and sustained program of study.

INTEGRATION/Information Literacies: Gather, interpret, evaluate, and apply information discerningly from a variety of sources.

INTEGRATION/Integrate Learning: Resolve difficult issues creatively by employing multiple systems and tools.

KNOWLEDGE/Depth of Knowledge: Pursue disciplined, Inquiry-based learning in the major.

Student Outcomes listed in the ETAC/ABET Criterion 3 Addressed in this Course

Student Outcomes	Level
1. An ability to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline;	E
2. An ability to design solutions for well-defined technical problems and assist with the engineering design of systems, components, or processes appropriate to the discipline;	E
3. An ability to apply written, oral, and graphical communication in well-defined technical and non-technical environments; and an ability to identify and use appropriate technical literature;	E
4. an ability to conduct standard tests, measurements, and experiments and to analyze and interpret the results;	R
5. An ability to function effectively as a member of a technical team;	R

ABET Program Criteria: Computer Engineering Technology

Curricular Area	Level
a. TBD	
b. TBD	

***Legend**: I (Introduce), R (Reinforce) and E (Emphasize). Unmarked means not addressed.*

Brief list of topics to be covered

Week 1	Introduction to C/C++; Introduction to embedded system (examples, platforms and architecture); Data types, variables
Week 2	Operators, expressions, and preprocessor of C/C++ ; C/C++ programming tools Lab1. Get started with C++ programming
Week 3, 4	Control structures Lab2. Selection structure and find max and min of an array Array, strings Lab3. Processing strings and iteration according to user's input
Week 5, 6	Pointer and its applications Lab4. Pointer and dynamic memory allocation for data acquisition
Week 7	Functions for modular programming Lab5. Function: parameter passing by keypad scan
Week 8	Basics of Class and Object, abstraction and encapsulation, Inheritance (optional: polymorphism) Lab6. Create a Dimmer Light class
Week 9	Introduction to embedded systems: hardware system Lab7. Library and class of peripheral devices and access to peripheral devices
Week 10	Introduction to embedded systems: software system Lab8. Get started with an embedded system development platform (hardware and software)
Week 11, 12	Digital and analog outputs and inputs Lab9. Weather station by using a DHT22 and LCD display
Week 13	Serial and parallel communications Lab10. Bluetooth
Week 14	Memory access, storage media access Lab11. Connecting external devices via SPI bus
Week 15	Final project demonstration and presentation