September 12, 2015

METROPOLITAN STATE UNIVERSITY OF DENVER
Office of Academic and Student Affairs

REGULAR COURSE SYLLABUS

College of: Letters, Arts, and Sciences

Department: Mathematical and Computer Sciences

Prefix & Course Number: CS 3410 **Crosslisted With*:** _____

Course Title: Embedded Systems

Transcript Course Title (30 characters): Embedded Systems

Check All That Apply: Required for Major:_____ Required for Minor:_____ Specified Elective: _____

Required for Concentration:_____ Elective: X Service Course:_____

To receive Title IV financial aid funds, all institutions of higher education must comply with the federal definition of a credit hour. The Higher Learning Commission requires institutions to maintain policies and procedures for verifying compliane with this definition.

> *Federal Credit Hour Definition: A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than:*
> *(1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or (2) at least an equivalent amount of work as required in paragraph (1) of this definition for other activities as established by an institution, including laboratory work, internships, practica, studio work, and other academic work leading toward to the award of credit hours. 34CFR 600.2 (11/1/2010)*

Credit Hours: 4 (4+0) **Schedule Type:** L **Grade Mode:** L

Face-to-Face or Equivalent Hours per course:

Lecture 60 Lab _____ Internship _____ Practicum _____ Other: _____

Additional Student Work Hours per course: 120

Variable topics umbrella course: No X **Yes** _____ If Yes, number of credit hours allowed _____

Specified repeatable course: No X **Yes** _____

Prerequisite(s): CS 2050 and CS 2400 each with a grade 'C' or better or permission of instructor. (CS 3600 is recommended)

APPROVED:

A. J. Gordon	10/1/2015
Department Curriculum Committee	Date
L B Packer	10.1.2015
Department Chair OR Program Director	Date
Linda Lang-Lessatto	10/28/15
Dean OR Associate Dean	Date
	1.18.17
Associate VP, Academic Affairs	Date

*If crosslisted, attach completed Course Crosslisting Agreement Form

Prefix and Course Number: CS 3410 September 12, 2015
Corequisite(s): ____

Prerequisite(s) or Corequisite(s): ____

Banner Enforced Coding:
Prerequisite(s): CS 2050 and CS 2400, each with a grade of C
Corequisite(s): ____
Prerequisite(s) or Corequisite(s): ____

Registration restrictions: Level UG **Class** ____ **Program/Major** ____ **Student attribute** ____

Catalog Course Description:
This course presents the basics of embedded systems design, including computer architecture, custom designed digital devices, and software development principles. Design principles of hardware architecture are based on performance analysis and modeling of the embedded system structure. Students learn the organization of the processors, memory hierarchy, input/output peripherals and the interface with sensors and actuators. Software development is oriented to case studies from selected embedded application domains.

Required Reading and Other Materials will be equivalent to:
As required by the instructor.

Recommended Reading:
1. Vahid, F., Givardis, T. (2002). *Embedded Systems Design, a Unified Hardware/Software Introduction.* John Wiley and Sons Inc.
2. Wolf, M. (2014). *High-Performance Embedded Computing, second edition.* Morgan Kaufmann.

Specific, *Measurable* Student Behavioral Learning Objectives:
Upon completion of this course the student should be able to:
1. Understand and choose hardware architecture
2. Choose effective interfacing for embedded systems
3. Identify the design steps
4. Design simple embedded software applications
5. Perform team-based final project that can be hardware oriented, software oriented or theoretically oriented (performance and security)

Detailed Outline of Course Content (Major Topics and Subtopics):
I. Specification of the design steps of the embedded systems, modeling.
II. Embedded systems computer platforms
   A. Processor and memory configuration
   B. Peripherals, protocols and networking
III. Interfacing to sensors and actuators
IV. Software design
   A. Application software design
   B. Soft and hard real time requirements

Evaluation of Student Performance:

1. Homework Assignments
2. Examinations: midterm and final exams
3. Project