Minnesota State University, Mankato

Curriculum Proposal

Please type or select the requested information. Print completed forms, add appropriate paper attachments, and route through MSU's curriculum process for recommendations and decisions.

College: Science, Engineering and Technology
Department: Electrical and Computer Engineering and
Program: EET and CET Programs
Type of Change: COURSE PROPOSALS
Proposed Change in Number
Title Current: Microprocessors I
Title Proposed: Microprocessors I
24-Char. Abbrev: Microprocessors I

Proposal # 149
Effective Date of Change: 2006-07
Academic Year: 2006-07
(CIP #)
Course Designator Number of Credits
EET 454 4
EET 254 4

Include a course or program description for the Bulletin (30-40 words maximum for courses, 100 for programs):
A study of microcomputer hardware and software fundamentals, the instruction set and the addressing modes of a microprocessor/microcontroller, assembly programming, basic I/O concepts, parallel I/O methods, asynchronous serial I/O methods, synchronous serial I/O methods, A/D conversion, and timer applications.
Pre: EET 113

Rationale or Justification for change:
The proposed change in Course Number from EET 454 to EET 254 is to make the numbering consistent with the year (2) that students should take this required course in EET and CET programs.

***For General Education or Cultural Diversity Courses Only***

General Education Course:

<table>
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<tr>
<th>GE Category #</th>
<th>GE Category Name (Maximum of 3 Categories)</th>
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Cultural Diversity Course:

(Please check one.)

- Core (At least 75% devoted to topics of race, gender, sexual orientation, age, class, and disabilities as they occur in United States Society.)
- Related (At least 25% devoted to the above topics or to a global perspective on topics related to African American, Asian, Hispanic, and Native American inhabitants of the United States)

- For Writing Intensive Courses, attach a description of the kind and quantity of writing.
- For Upper Division Courses, include a description of the respects in which it is broad and general rather than narrow and specific, and so suitable as GE.

Attach paper copies of the following:

- a. Syllabus or course outline.
- b. Course's student learning outcomes associated with each GE competency or CD designation.
- c. List of strategies to be used to assess students' achievement of each GE competency or CD designation.

***For New Courses***

(Check all that apply.)

- Instructional Type: Lecture/Lab
- Course is an elective.
- Course is required for program EET and CET
- Pre- or Co-requisites: Pre: EET 113
- Other courses are being changed or eliminated. (Explain.)

- Course content or title is similar to courses in other departments. (Attach copy of letter of agreement with other program(s) contacted. Indicate the nature of the discussions and/or resolution of differences or potential conflicts.)

Attach paper copies of the following:

- a. Syllabus or course outline.
- b. Course's student learning outcomes.
- c. A list of resources required to offer and support this course.
- d. A description of how teaching this course will affect department staffing.
- e. If 400/500 level course, an explanation of added expectations of graduate students.

Revised September 2002
### Minnesota State University, Mankato

**Curriculum Proposal**

#### ***Signature Page***

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**Comments:**

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3 Revised September 2002
Instructor: Dr. Han-Way Huang
Classroom: WH286A
Office: TE 324
Phone: 389-1121
Textbook: “MC68HC12-An Introduction” by Han-Way Huang; Delmar Thompson
          “Programmable Logic Controllers” by W. Bolton, published by Newnes

Contents:
- Architecture of the Motorola 68HC12 microcontroller
- 68HC12 Assembly Language Programming
- Write program loops to perform repetitive operations
- Data structures and subroutine calls in the 68HC12
- Interrupts and resets
- Parallel Input and Outputs and simple I/O devices including LED, LCD, seven-segment, keypad input, D/A converter, stepping motor.
- The 68HC12 timer functions and their applications such as pulse width, period, frequency, and duty cycle measurement.
- Applications of programmable logic controller and I/O devices
- Programming of PLC
- Internal relays, timers, counters in PLC
- Data handling in PLC
- Program designs, testing, and debugging for PLC

Objectives
After taking this course, you will be able to

1. Use microprocessor addressing modes in specifying operands for instructions.
2. Use microprocessor instructions to perform arithmetic and logic operations
3. Use appropriate instructions to write program loops to perform repetitive operations
4. Write modular programs by dividing a large program into subroutines
5. Understand interrupts and be able to write interrupt-driven programs
6. Use parallel ports to perform input and output operations (including D/A conversion)
7. Use timer function in measuring frequencies, pulse widths, periods, and generating waveforms.
8. Under the applications of PLC
9. Learn the components of PLC including internal relays, timers, counters, and shift registers.
10. Learn to design and test PLC programs

Tentative Schedule
Week 1 (01/18–01/20): computer hardware, software, 68HC12 addressing modes, and some
68HC12 instructions.
Week 2 (01/23–01/27): assembly program structure, assembler directives, writing assembly
program to perform arithmetic operations, and writing program loops.
Week 3 (01/30–02/03): bit manipulation instructions, shift and rotate instructions, and program
execution times.
Week 4 (02/06–02/10): stacks, arrays, strings, subroutine calls, and stack frame.
Week 5 (02/13–02/17): modular programming, examples of subroutines, and using D-Bug12 functions to perform I/O functions.
Week 6 (02/20–02/24): exam 1, exam 1 solution, concepts of interrupts and resets, interrupt programming, and 68HC12 interrupts.
Week 7 (02/27–03/03): 68HC12 resets, watchdog timer, and writing interrupt service routine under D-bug12 monitor.
Week 8 (03/06–03/10): 68HC12 operation modes, basic I/O concepts, I/O synchronization methods, and 68HC12 parallel I/O ports.
Week 9 (03/20–03/24): interfacing with LEDs, seven-segment displays, and Lads, keyboard and keypad scanning and debouncing,
Week 10 (03/27–03/31): driving D/A converter with a parallel port, stepper motor control, and 68HC12 standard timer module.
Week 11 (04/03–04/07): exam 2, input capture and its applications including period, frequency, and pulse width measurements.
Week 12 (04/10–04/14): output-compare operation, generating waveform, sound, and delays using output-compare function, and PWM module.
Week 13 (04/17–04/21): PLC applications, input and output devices for PLC.
Week 14 (04/24–04/28): PLC ladder programming, internal relays, and timers.
Week 15 (05/01–05/05): counters, shifters, data handling, design programs, and testing and debugging.

Exams
Exams will be given at the time scheduled. If you cannot make that time, talk to the instructor ahead of time to make alternate arrangement. Unexcused absence will result in zero credit. No electronic devices will be allowed during the exams including (but not limited to): calculators, phones, PDAs, MP3/CD players.
- Exam 1: February 20 (Monday)
- Exam 2: April 03 (Monday)
- Final: 10:15 a.m.-12:15 am. May 09 (Tuesday).

Homework
Assignments are due at the beginning of class on the day stated. In the event a hardcopy cannot be turned in at that time, an e-mail containing your completed and finished assignment as a word document or JPEG will suffice until you can turn in the hardcopy. Late assignment will be penalized at a rate of 25% per day. Copying your classmate’s homework is not allowed and will receive a score of zero on that homework for both.

Grading methods

Exam 1 and Exam 2: 17.5% each, Homework: 15%, Lab assignments: 25%, Final Exam: 25%

- A: > 85%
- B: from 70% to less than 85%
- C: from 55% to less than 69%
- D: from 40% to less than 55%
- F: below 40%
EET 454 254 – Course Outcomes

Upon completion of this course the student should be able to:

1. Implement AND, OR, NOT, and XOR functions on a PLC in ladder logic.

2. Use timers and counters on a PLC.

3. Use relay outputs on a PLC and explain how they work.

4. Explain how optical-isolator inputs work on a PLC.

5. Use various addressing modes to access microprocessor/microcontroller memory.

6. Use a microprocessor/microcontroller to perform arithmetic and logical operations.

7. Use functions calls or subroutines to divide a larger program into modules.

8. Write interrupt driven programs and explain how interrupts function.

9. Use a microprocessor’s parallel ports to interface with simple I/O devices, such as DIP switches, keypads, seven-segment displays, LCDs, or D/A converters.

10. Use the microprocessor’s analog to digital converter to capture real world conditions such as temperature and then generate the characteristic polynomial equation in a spreadsheet to convert the results.

11. Use the microprocessor’s timer functions to create time delays.

12. Use PWM or timer functions to control DC motors and frequency dependant servos.

13. Use the microprocessor’s timer functions to measure waveform characteristics such as pulse width, period, frequency, or duty cycle.

14. Use the debugger to identify and correct source code mistakes on the demo board.

15. Use the microprocessor’s UART module to receive commands from the PC and display results back on the PC.

16. Explain and compare basic differences and benefits between serial and parallel communications.
Staff Impact – Staffing resources to support this course will result from allocation of existing department resources and with the assistance of the College of Science Engineering and Technology to support and growth and advancement of ECET programs.
EET 254 Microprocessors I
Course Proposal
Resource Needs

Resources to support this course will result from allocation of existing department resources and with the assistance of the College of Science Engineering and Technology to support and growth and advancement of ECET programs."
This proposal is requesting permission to change the microprocessor course level designation from 454 to 254. This request is occurring because many students transferring into the Bachelors degree program from two year programs have taken a microprocessor course during their two year program of study. To better accommodate these transfer students we would like to provide an equivalent transfer level course offered during the Sophomore year in the Electronic Engineering Technology and Computer Engineering Technology programs. The scope of this course and the concepts presented in this course will be simplified to be appropriate for a 200 level course. Advanced microprocessor and microcontroller concepts will be covered in the 400 level advanced microprocessor course.