MERRITT COLLEGE COURSE OUTLINE

COLLEGE:		**STATE APPROVAL DATE:**	12/06/2017
ORIGINATOR:	Courtney Brown	**STATE CONTROL NUMBER:**	CCC000587 311
		BOARD OF TRUSTEES APPROVAL DATE:	06/13/2017
		CURRICULUM COMMITTEE APPROVAL DATE:	05/01/2017
		CURRENT EFFECTIVE DATE:	01/22/2018

DIVISION/DEPARTMENT:

1. REQUESTED CREDIT CLASSIFICATION:

Credit - Degree Applicable
Course is not a basic skills course.
Program Applicable

2. DEPT/COURSE NO:

CIS 078

3. COURSE TITLE:

Digital Architectures for Computation

4. COURSE: MC New Course

TOP NO. 0706.00

5. UNITS: 4.000

HRS/WK LEC: 3.00 Total: 52.50
HRS/WK LAB: 3.00 Total: 52.50
HRS/WK TBA:

6. NO. OF TIMES OFFERED AS SELETED TOPIC: AVERAGE ENROLLMENT:

7. JUSTIFICATION FOR COURSE:

One of the courses in a sequence defined by the Association for Computing Machinery (ACM), this is a requirement for Associate of Science in Computer Science. It is also required for transfer to four-year college level Computer Science departments. It fulfills requirements for an A.S.-T degree which provides priority placement in CSU computer science programs. It is required to meet national Cybersecurity Education standards; specifically Center For Academic Excellence-2 Year in Cyber-Defense (CAE2Y-CD) and The National IA Education & Training Program (NIETP). Alignment with these programs permits articulation to any four-year cybersecurity program nation-wide. It also aligns with workforce development initiatives which include scholarship opportunities for students. This course will enable PCCD to offer the A.S. degree in Computer Science. Course is transferable to the CSU/UC systems and meets AA/AS area 4c requirements.

8. COURSE/CATALOG DESCRIPTION

Organization of digital circuits and computing architectures: Fundamentals of digital circuits, combinational logic and sequential logic; processor components and processing architectures such as Von Neumann and Harvard architecture; control unit instruction word decoding and Instruction Level Parallelism (ILP); high level, assembly, and machine code; memory addressing modes, performance, and memory models; Random Access Model (RAM) and Candidate Type Architecture (CTA); analysis of single threaded code.

9. OTHER CATALOG INFORMATION

a. Modular: No If yes, how many modules:
b. Open entry/open exit: No
c. Grading Policy: Letter Grade Only
d. Eligible for credit by Exam: No
e. Repeatable according to state guidelines: No
f. Required for degree/certificate (specify):
Computer Science AS
g. Meets GE/Transfer requirements (specify):
AA/AS area 4c; Acceptable for credit: CSU, UC (pending)

h. C-ID Number: 142 Expiration Date:

i. Are there prerequisites/corequisites/recommended preparation for this course? Yes

10. LIST STUDENT PERFORMANCE OBJECTIVES (EXIT SKILLS): (Objectives must define the exit skills required of students and include criteria identified in Items 12, 14, and 15 - critical thinking, essay writing, problem solving, written/verbal communications, computational skills, working with others, workplace needs, SCANS competencies, all aspects of the industry, etc.)(See SCANS/All Aspects of Industry Worksheet.)

Students will be able to:

1. Identify the components in a system that perform computation and categorize the architecture.
2. Describe the components of a computer instruction and explain the resulting state and contents of memory and registers.
3. Write simple assembly language program segments
4. Write programs that use high-level programming constructs using assembly language
5. Design simple sequential and/or combinational logic circuits using transition diagrams, state tables and basic logic components.
6. Minimize the number of components in a digital circuit using boolean algebra.

11A. COURSE CONTENT: List major topics to be covered. This section must be more than listing chapter headings from a textbook. Outline the course content, including essential topics, major subdivisions, and supporting details. It should include enough information so that a faculty member from any institution will have a clear understanding of the material taught in the course and the approximate length of time devoted to each. There should be congruence among the catalog description, lecture and/or lab content, student performance objectives, and the student learning outcomes. List percent of time spent on each topic; ensure percentages total 100%.

LECTURE CONTENT:

LECTURE CONTENT:

1. Digital Systems -12.5%
2. Machine Level Representation of Data -12.5%
3. Assembly Level machine organization and instruction set design -12.5%
4. Assembly language programming of a model machine - 12.5%
5. Memory Systems - 12.5%
6. Functional Organization - 12.5%
7. Parallel Programming - 12.5%
8. Advanced Topics - 12.5%

11B. LAB CONTENT:

LAB CONTENT:

1. Solve multiple digital logic problems as assigned15%

2. One large project or several small assignments to design and diagram simple combinational and sequential circuits 20%

3. One large assignment or several small ones that require writing and debugging assembly language programs including decisions, procedures, pointers, and arrays.20%

4. Converting integer data between radixes, and encoding floating-point data in binary15%

5. Translating higher-level language to assembly language and discussing issues that arise 15%

6. Solving circuit minimization problems using Boolean Algebra and standard minimization techniques. 15%

12. **METHODS OF INSTRUCTION** (List methods used to present course content.)

1. Distance Education
2. Lecture
3. Lab
4. Observation and Demonstration
5. Discussion
6. Projects
7. Directed Study
8. Threaded Discussions

13. **ASSIGNMENTS:** 6.00 hours/week (List all assignments, including library assignments. Requires two (2) hours of independent work outside of class for each unit/weekly lecture hour. Outside assignments are not required for lab-only courses, although they can be given.)
Out-of-class Assignments:
One large assignment or several small ones that require writing and debugging assembly language programs including decisions, procedures, pointers, and arrays. One large project or several small assignments that require designing and diagramming sample combinational and sequential digital circuits. Solve multiple digital logic problems as assigned.

ASSIGNMENTS ARE: (See definition of college level):
Primarily College Level

14. **STUDENT ASSESSMENT:** (Grades are based on):
COMPUTATION SKILLS
SKILL DEMONSTRATION
MULTIPLE CHOICE
ESSAY (Includes "blue book" exams and any written assignment of sufficient length and complexity to require students to select and organize ideas, to explain and support the ideas, and to demonstrate critical thinking skills.)
OTHER (Describe):
Design and/or implementation of digital circuit projects.

15. **TEXTS, READINGS, AND MATERIALS**

A. Textbooks:

David A. Patterson, John L. Hennessy. *Computer Organization and Design, The Hardware/Software Interface (The Morgan Kaufmann Series in Computer Architecture and Design)..* 5 Morgan Kaufmann, 2015.

Robert G. Plantz, Ph.D. *Introduction to Computer Organization with x86-64 Assembly Language & GNU/Linux.* 1 Robert G. Plantz, Ph.D, 2015.

*Date is required: Transfer institutions require current publication date(s) within 5 years of outline addition/update.

B. Additional Resources:

Library/LRC Materials and Services:

The instructor, in consultation with a librarian, has reviewed the materials and services of the College Library/LRC in the subject areas related to the proposed new course

Are print materials adequate? No

Are nonprint materials adequate? No

Are electronic/online resources available? No

Are services adequate? No

Specific materials and/or services needed have been identified and discussed. Librarian comments:

C. Readings listed in A and B above are: (See definition of college level):

Primarily college level

16. DESIGNATE OCCUPATIONAL CODE:
E - Non-Occupational

17. LEVEL BELOW TRANSFER:
Y = Not Applicable

SUPPLEMENTAL PAGE

Use only if additional space is needed. (Type the item number which is to be continued, followed by "continued." Show the page number in the blank at the bottom of the page. If the item being continued is on page 2 of the outline, the first supplemental page will be "2a." If additional supplemental pages are required for page 2, they are to be numbered as 2b, 2c, etc.)

1a. Prerequisites/Corequisites/Recommended Preparation:
PREREQUISITE(S):

CIS 006: Introduction to Computer Programming Entry Skills: Create programs to solve computable problems in a high-level programming language. 2. Use the various standard data types. 3. Correctly utilize programming flow controls. 4. Explain array structures and usage. 5. Explain structured programming concepts and their implementation in a high-level language.

RECOMMENDED PREPARATION:

CIS 072: Systems and Network Administration
Subject course and pre/corequisite is: Sequential
MATH 011: Discrete Mathematics
Subject course and pre/corequisite is: Sequential

OTHER (E.G. HEALTH AND SAFETY):

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STUDENT LEARNING OUTCOMES

1. **Outcome:** Select appropriate design for combinational circuits apply circuit minimization techniques.
   Assessment: Assign design project and compare the solution submitted to reference designs.

2. **Outcome:** Analyze simple sequential circuits using transition diagrams and state tables and plan their implementation.
   Assessment: Assign design project and assess the work products created in order to complete it. This may include items like narrative descriptions, schematic, subsystem or components assembled into a physical circuit..

3. **Outcome:** Identify higher-level programming language control structures and implement their assembly language replica.
   Assessment: Student is assigned problem and designs an implementation that is assessed on correct

choice of control structures and algorithms.

4. **Outcome:** Explain the process of arithmetic at the machine level using various types of data including two's-complement integer, floating point, character and pointer data and their aggregates.
   Assessment: Projects, exam and quiz questions, projects requiring any or all of the skills described are assigned.

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