MILLERSVILLE UNIVERSITY
Department of Applied Engineering, Safety, & Technology

ITEC 364 DIGITAL ELECTRONICS
3 s.h.

CATALOG DESCRIPTION
Practical applications of digital logic for processing electronically encoded information. Covering numbering systems, logic design, basic gates, sequential and combinational logic, and digital troubleshooting. 2 hours lecture, 3 hours lab. Prerequisite: ITEC 262 or permission of instructor.

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

1. Compare and contrast three different logic families relative to speed, power consumption, and troubleshooting procedures.
2. Explain the function of various gates common to digital logic circuits.
3. Derive truth tables for various gates, combinational logic, and sequential logic circuits.
4. Design simple digital logic circuits to perform specified functions.
5. Describe the operation of various digital circuits including timers, counters, flip-flops, adders, and multiplexers.

COURSE OUTLINE
I. Number Systems
   A. Conversion between systems
   B. Addition and subtraction
II. Gates and Inverters
   A. Basic gates and inverters
   B. Enable/inhibit functions
   C. Expanding gates
III. Waveforms and Boolean Algebra
   A. Waveform analysis
   B. Delayed clock and shift counter waveforms
   C. Combinational logic
   D. Boolean Theorems
   E. Demorgan’s Theorems
   F. Karnaugh Mapping
IV. Exclusive - OR Gates
   A. Exclusive - OR Gates
   B. Exclusive - NOR Gates
   C. Parity generator/checker
   D. Comparators
V. Adders
   A. Half adder
   B. Full adder
   C. 1’s complement subtraction
   D. 1’s complement adder/subtractor
   E. 2’s complement subtraction
   F. Signed 2’s complement subtraction
   G. BCD addition
VI. Specifications and Open Collector Gates
   A. TTL Subfamilies
   B. Noise Margins
   C. Sinking current
   D. Fan-out
E. Switching characteristics (propagation)
F. TTL open collector gates
G. CMOS Subfamilies
H. Interfacing families

VII. Flip-Flops
   A. Crossed NAND
   B. Crossed NOR
   C. Transparent D
   D. Gated Set-Reset
   E. Master - Slave D

VIII. Master-Slave D and JK Flip-Flops
   A. Toggling
   B. JK Flip-flop
   C. Shift Counter

IX. Shift Registers
   A. Parallel data
   B. Serial data
   C. RS-232 transmission
   D. Asynchronous data transfer
   E. Synchronous data transfer

X. Counters
   A. Ripple counters
   B. Divide by "N" counters
   C. Up-down counters

XI. Schmitt-Trigger Inputs and Clocks
   A. Schmitt-Trigger clock
   B. The 555 clock
   C. Crystal oscillators

XII. One-Shots
   A. Debounce Switch
   B. Pulse stretching
   C. Retriggerable
   D. Non-retriggerable

XIII. D/A and A/D Conversions
   A. Resistor networks
   B. Set-points

XIV. Decoders, Multiplexers, Demultiplexers and Displays
   A. Decoders
   B. Demultiplexers
   C. Multiplexers

XV. Tri-State Gates and Interfacing to High Current
    A. Tri-state gates
    B. Interfacing

REQUIRED MATERIALS
Lecture Notes: Wright, Jr., J. R. (2012). Campus Bookstore, Millersville University
Test Leads.

GENERAL COURSE REQUIREMENTS
Students are expected to participate in or complete the following:

1. Obtain the required text.
2. Participate in class discussions.
3. Complete and submit all required experiments.
4. Satisfactorily complete all tests/quizzes and labs.
5. Participate in all assigned clean-up activities at the end of each class session.
6. Regularly attend all lecture and laboratory sessions in their entirety. The instructor will maintain an attendance record during both lecture and laboratory segments. The attendance policy adopted by the AEST Department will be in effect (see Attendance Policy section of this syllabus); unauthorized absences exceeding the number permitted in the departmental policy (3) will result in removal from the course, and a grade of “F” will be assigned. A copy of the departmental policy concerning attendance is posted on the bulletin boards in both the laboratory and the lecture room. Attendance will be a factor in “letters of recommendation” requested by the student from the course instructor.

EVALUATION
Course activities will be divided into the following categories:

- Lab Experiments with Synopses (6 @ 5% each) 30%
- Final Project 30%
- Take Home Exams (2 @ 20% each) 40%
- Final Project Bonus Assignment 10%

Total: 110%

Scale:

- 93 - 100 A
- 80 – 82.9 B-
- 67 – 69.9 D+
- 90 – 92.9 A-
- 77 – 79.9 C+
- 63 – 66.9 D
- 87 – 89.9 B+
- 73 – 76.9 C
- 60 – 62.9 D-
- 83 – 86.9 B
- 70 – 72.9 C-
- below 60 F

Should the end-of-semester mean score for the class fall below 75%, each student will receive a curve to fit the mean of 75%.

Grades will not be based upon criteria such as need, appearance, race, age, sex, or social status. Once determined, grades will not be changed except in the case of clerical errors that cause the student’s true level of ability to be underestimated.

NOTES: When any soldering is attempted, safety glasses are to be worn. The instructor reserves the right to alter this syllabus as required.

MILLERSVILLE UNIVERSITY ATTENDANCE POLICY
EFFECTIVE SPRING 2003
Approved by Faculty Senate 12/4/02; Administrative approval 1/10/03

The University supports departmental and faculty class attendance policies that are reflective of and consistent with University approved guidelines. Faculty will include their class attendance policy in their syllabi given to all students in their classes at the start of the semester.

University approved guidelines:

1. Students are expected to attend all classes. It is the student’s responsibility to complete all course requirements even if a class is missed. If a student misses class for an officially excused reason, then he/she is entitled to make up the missed work but only at the convenience of the faculty member. Responsibility for materials presented in, assignments made for, and tests/ quizzes given in regularly scheduled classes lies solely with the student.

2. The University policy is that faculty will excuse absences for the following reasons:
   a. personal illness,
   b. death or critical illness in the family,
   c. participation in a university-sponsored activity,
   d. jury duty,
   e. military duties, or
   f. religious holidays

3. Faculty judge the validity of student absences from class within the University’s approved guidelines and may require documentation for excused absences. Faculty will evaluate any
reason, other than those listed above, for a student missing class and determine whether the absence is justified. In these circumstances, a student may make up missed work at the discretion of the instructor.

4. **In the case of foreseeable absences, students are encouraged to notify the faculty member in advance.** A student who will miss class due to participation in an official University activity must notify the instructor well in advance of the activity to assure that the absence is excused.

**Appeals:**
As with any academic issue, students may exercise their right to appeal adverse attendance decisions. Please refer to the current undergraduate catalog for the complete Academic Appeal procedure.

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**AEST DEPARTMENT ATTENDANCE POLICY**

*Adopted May 4, 1998*

Students are expected to attend all scheduled classes in accordance with the above policy. To the extent that this does not happen, the following shall apply:

1. The limit of unauthorized absences depends upon the number of scheduled days per week as follows:
   - **Fall and spring semesters**
     - three per semester for a course scheduled three days per week
     - two per semester for a course scheduled one or two days per week
   - **Winter and summer sessions**
     - two per session

2. Each late arrival and early departure will count as one-half of an unauthorized absence.
3. Participation in outside-of-the-classroom educational activities and intercollegiate contests shall be communicated to the instructor prior to the absence. Failure to do so will convert these authorized absences to “unauthorized absences.”
4. Students whose “unauthorized” absences exceed the policy stated in item #1 are liable to dismissal from the course with a grade of ‘F’ or ‘Z.’

**STUDENTS WITH SPECIAL NEEDS**
The instructor will provide reasonable accommodations to any student with special needs. The student is encouraged to inform the instructor of any condition that requires such accommodations. Also, it is the student’s responsibility to contact the Office of Learning Services, Room 348, Lyle Hall (Phone 872-3178) to request an official approval for providing any special accommodations and present a copy of this official document to the instructor.

**TITLE IX**
Millersville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment, comply with Title IX of the Education Amendments of 1972, 20 U.S.C. §1681, et seq., and act in accordance with guidance from the Office for Civil Rights, the University requires faculty members to report to the University’s Title IX Coordinator incidents of sexual violence shared by students. The only exceptions to the faculty member’s reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report to the person designated in the University Protection of Minors policy incidents of sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred.
Information regarding the reporting of sexual violence, and the resources that are available to victims of sexual violence, is available at http://www.millersville.edu/socialeq/title-ix-sexual-misconduct/index.php.

SELECTED REFERENCES