Eastern Kentucky University
Department of Technology

Syllabus for EET 252-001, Digital Electronics, 20231
3 credit hours
Spring 2010

Instructor:     Prof. Vigs Chandra, PhD
Office:        405 Whalin Technology Complex
Telephone:     859-622-1187
E-mail:        vigs.chandra@eku.edu
Web:           http://people.eku.edu/chandrav

Class schedule: Section 001, CRN: 20231; MW: 8 a.m. - 9:55 a.m., in Room 407/403
Office Hours:  MTWR: 10 a.m. – 11:30 a.m., and 4:30 p.m. - 6 p.m. If my office door is open at other times I will most likely be available for discussion. Come right in. You may email me regarding additional meeting times if needed.

CATALOG COURSE DESCRIPTION:
A survey of digital electronics fundamentals and applications: Digital mathematics, logic families, logic gates, multiplexers, comparators, counters, decoders, displays, converters, memory systems, and microcomputer systems are covered in a combination of lecture, demonstration, and laboratory.

Prerequisite:
Grade of at least a “C” in MAT 090 or equivalent

TEXTS:

STUDENT LEARNING OUTCOMES:
Upon completion of this course, the student will:

1. Explain the fundamental concepts of electricity/electronics pertaining to digital devices.
2. Define the two state concept and its use in digital systems.
3. Use the Binary, Decimal, Octal, and Hexadecimal number systems, including number conversions between different systems, and perform arithmetic operations.
4. Explain the difference between combinational and sequential digital devices.
5. Sketch the symbol for, describe the operation of, and implement AND, OR, INVERTER, NAND, NOR, XOR, XNOR logic gates.
6. Use Truth Tables to design, simplify, and implement digital circuits for given design specifications.
7. Sketch the symbol for, describe the operation of, and implement digital circuits that include 7-segment displays, decoders, encoders, multiplexers, demultiplexers, binary comparators, timers, flip-flops, latches, counters.
8. Interpret manufacturer’s specifications for a given digital component and then use the specifications to construct and test a circuit.

EKU will develop informed, critical & creative thinkers who communicate effectively.
(EKU Quality Enhancement Plan, 2009)
11. Sketch the block diagram of a simple microcomputer system, and describe the function of the CPU, memory, storage, I/O, and buses.
12. Maintain proper safety precautions while handling and using digital electronic circuits.
13. Test and troubleshoot the operation of electronic devices using proper instruments and procedures.
15. Communicate circuit construction procedures, testing/troubleshooting steps, and experimental results in writing.

COURSE OUTLINE:
1. Digital Electronic Introduction (Week 1-2)
   a. Digital electronic systems and applications
   b. Two-state electrical representation
   c. Logic levels
   d. Circuit simulation software
   e. Measuring and test equipment in digital electronics
2. Number systems (Week 2-3)
   a. Binary, Octal, and Hexadecimal number systems
   b. Converting between different number systems
   c. Digital codes
      (i) Binary Coded Decimal (BCD)
      (ii) American Standard Code for Information Interchange (ASCII)
      (iii) Gray/Reflected binary code
3. Logic gates (Week 3-4)
   a. Basic logic gates: INVERTER (NOT), AND, OR
   b. Universal gates: NAND, NOR
   c. XOR
   d. XNOR
   e. Designing and implementing combinational circuits using logic gates
4. Boolean logic (Week 4-5)
   a. Boolean algebra
   b. Expressing combinational logic circuits using
      (i) sum-of-products (SOP)
      (ii) products-of-sum (POS) forms
   c. DeMorgan’s theorems
   d. Logic circuit minimization
   e. Karnaugh Maps for simplifying Boolean expressions
5. Devices implementing combinational logic functions (Week 5-7)
   a. Half- and Full-Adders
   b. Magnitude comparators
   c. Encoders and Decoders
   d. Multiplexers and Demultiplexers
   e. Displays
6. Digital electronics combinational logic mini-project (Week 7-8)
7. Sequential Circuits (Week 10-13)
   a. Timers
   b. latches
   c. flip flops – D, JK
   d. counters
   e. shift registers
   f. Designing and implementing sequential circuits

8. Digital electronics sequential logic mini-project (Week 13-15)

9. Advanced digital systems (Week 15-16, as time permits)
   a. Data, address, and control buses
   b. Tri-state devices
   c. Arithmetic and Logic Unit (ALU)
   d. Memory – ROM, RAM
   e. Digital computer organization
   f. Input and output devices – digital/analog
   g. Digital/Analog and Analog/Digital conversion for interfacing

**EVALUATION METHODS:**
Each student will be evaluated as follows:
- Assessments (40%) – 3, including the final
- Laboratory activities (35%) – 12-15 (approx.)
- Digital electronics mini-projects (15%) – 2 (combinational and sequential area)
- Assignments (10%) – 8-10 (approx.)

**Assessments:**
1st assessment – (in-class, objective/short answer format), covering class notes, labs, assignments, classroom discussions, and selected textbook content, related to digital electronics basics, number systems, and logic gates and simplification. To be held during the 6th week (Feb. 15-18) of the semester.

2nd assessment – (in-class, objective/short answer format), covering class notes, labs, assignments, classroom discussions, and selected textbook content, related primarily to sequential devices. To be held during the 13th week (Apr. 5-9) of the semester.

Final Assessment – (in-class, objective/short answer format, one side of a 3 in. x 5 in. index card of handwritten notes permitted) – Comprehensive, covering class notes, labs, assignments, classroom discussions, and selected textbook content from Ch. 1 – 9. To be held Monday, May 3, 8 a.m. -10 p.m.

\[
\text{Assessment average} = \frac{\text{Equally weighted } (1^{\text{st}} + 2^{\text{nd}} + \text{Final}) \text{ Assessments}}{3}
\]

Your may rework and resubmit labs, homework, papers and assessments (excluding the final) for limited partial credit.

**Laboratory activities:** There will be approximately 12-15 labs as time permits, each weighed equally. Each student will be issued a kit of parts. Students must supply their own storage tackle or tool box, and/or arrange for a locker in the department for storing the kit.
**Digital electronics mini-projects**: Two mini-projects, one of a combinational logic system and the next of a sequential system will be designed, simulated, implemented and tested in the laboratory. Groups of up to three students are permitted while working on the mini-project. Individually written reports are to be completed and submitted in a template, similar to that of the laboratory reports, which will be provided. The working mini-projects, along with completed laboratory reports, count for 15% of the final grade. Multisim simulations along with digital photos of the mini-project are to be included with the report.

The report should include at least two references, formatted using American Psychological Association (APA) guidelines, available online at [http://nutsandbolts.washcoll.edu/apa.html](http://nutsandbolts.washcoll.edu/apa.html). If online sources are used, the reference should also include a persistent link to the article when possible. Refer to the Academic Search Premier Database ([http://www.library.eku.edu/new/index.php](http://www.library.eku.edu/new/index.php)) which is made available through the EKU libraries, for identifying articles related to the topic. Refer to an online video tutorial on using the EKU library databases for retrieving articles (the EKU libraries website may have changed slightly, but the procedure for searching articles is likely to be similar to this): [http://www.people.eku.edu/chandrav/Ref/onlineArticlesEKU.wmv](http://www.people.eku.edu/chandrav/Ref/onlineArticlesEKU.wmv).

**Assignments**: There will be approximately 10 homework assignments covering material from the text and topics discussed in class.

Students may rework and resubmit assessments (except the final), assignments or labs for limited partial credit. Labs and paragraphs turned in late will have reduced credit.

Students are encouraged to maintain an EET252 class portfolio, which will be useful in organizing class materials – maintain separate sections for notes, laboratory activities, mini-projects, assessments, assignments, and reference materials including data sheets and handouts.

**Course Requirements:**
Students are expected to:
1. Attend each lecture and laboratory session.
2. Complete all homework submit these on the prescribed dates.
3. Complete assigned labs and simulations as prescribed by the instructor.
4. Complete the assessments covering material from the assignments, labs, classroom discussions, and textbook.
5. Maintain a 3-ring binder or folder for organizing class and reference materials

**Grades:**

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<thead>
<tr>
<th>Percentage Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>100-90%</td>
<td>A</td>
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<tr>
<td>89.9-80%</td>
<td>A</td>
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<tr>
<td>79.9-70%</td>
<td>A</td>
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<tr>
<td>69.9-60%</td>
<td>B</td>
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<tr>
<td>Below 60%</td>
<td>C</td>
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Mid-term grades will be made available to students by Friday, March 5, 2010.

Tuesday, May 11, 2010 – Final grades available online under EKUDirect/StudentRecords/Official Grade Report
STUDENT PROGRESS:
Students will be informed of their progress in the course after the 1st assessment (approximately 6th week of the semester). All students are encouraged to meet with me for discussing their progress as well as to identify opportunities for improvement at any time during the semester.

Friday, March 19, 2010 – Last day to withdraw with a "W" from a full-semester class, or to withdraw from full-semester classes or withdraw from the university.

OFFICIAL E-MAIL:
An official EKU e-mail is established for each registered student, each faculty member, and each staff member. All university communications sent via e-mail will be sent to this EKU e-mail address.

ATTENDANCE POLICY:
Regular attendance is needed for students in order to successfully complete the course. After the second (2), unexcused absence each unexcused absence will cause a five percent (5%) deduction in the overall percentage. Five (5) to seven (7) unexcused absences will result in one letter grade lower each. Your grade will be an automatic F if you have more than seven (7) unexcused absences. If you have a university accepted excused absence, make-up work is permitted with no penalty. Makeup labs/exams will be permitted only if you had sought and received my approval prior to the absence which caused you to miss the related lab/exam.

You will benefit most by way of understanding the content of the course by completing all the assigned work in a timely manner. If you know in advance that you will be absent, please inform me at the earliest. Email is usually the fastest way of contacting me.

Cell Phones: Cellular phones should be off or on silent operation during class in order to keep classroom distractions at a minimum. Under special circumstances students are permitted to use the phone but should seek my approval prior to class.

DISABILITY STATEMENT:
If you are registered with the Office of Services for Individuals with Disabilities, please obtain your accommodation letters from the OSID and present them to the course instructor to discuss any academic accommodations you need. If you believe you need accommodation and are not registered with the OSID, please contact the Office in the Student Services Building Room 361 by email at disserv@eku.edu or by telephone at (859) 622-2933 V/TDD. Upon individual request, this syllabus can be made available in an alternative format.

ACADEMIC INTEGRITY STATEMENT:
Students are advised that EKU’s Academic Integrity policy will strictly be enforced in this course. The Academic Integrity policy is available at www.academicintegrity.eku.edu. Questions regarding the policy may be directed to the Office of Academic Integrity.

😊 The work you do in the laboratory, and the grade you earn, should reflect your personal abilities, and accomplishments. Individual homework and lab reports are required from each student. I encourage you to discuss class assignments with other students. However any work you submit must be your own.

😊 Any suggestions leading to improvements in the content or presentation of the course, especially in the laboratory work, are most welcome.