I. INTRODUCTION

A. A course in electronics covering digital systems. Emphasis on application and troubleshooting digital systems.

B. This course serves as a required or elective course on various degree plans. Curriculum plans for degrees and certificates, are listed in the current Central Texas College Catalog.

C. The delivery method of this course may be traditional lecture/lab, blended lecture/lab, or online

D. Prerequisite: CETT 1325 Digital Fundamentals.

II. LEARNING OUTCOMES

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

A. Analyze and troubleshoot digital systems (C1, C5, C6, C7, C8, C15, C16, C18, C19, C20, F1, F3, F8, F9, F10, F16)

B. Design and construct a digital system incorporating TTL and/or CMOS devices as a team member or team leader. (C3, C4, C5, C6, C7, C8, C9, C10, C12, C13, C14, C15, C16, C17, C18, C19, F1, F2, F3, F5, F6, F8, F9, F10, F13, F15, F16)

III. INSTRUCTIONAL MATERIALS

A. The instructional materials identified for this course are viewable through www.ctcd.edu/books

B. Students will need an engineering calculator with trigonometric and exponents functions. Programmable calculators are not allowed on examinations.

C. A breadboard with 2200 tie-points or more. Approximate board size will be 7” by 7”.

November 2016
IV. COURSE REQUIREMENTS

A. Attend both lecture and lab or in the case of online delivery, be actively engaged in Blackboard and maintain constant progress.

B. Be prepared to participate in discussion, team projects/assignments and take unannounced assessments relating to the lecture materials.

C. Complete all exams/assessments.

D. Submit all assignments on time.

V. ASSESSMENTS

A. Student content mastery will be evaluated in the following areas:
   - Homework, Quizzes
   - Assessments (midterm exam, lab projects)
   - Final Assessment (final exam and/or semester project, participation)

B. Scheduled and unscheduled assessments will be given at the discretion of the instructor.

C. Exams/assessments may be composed of both subjective and objective questions plus computer output.

D. A student must take all exams/assessments. No make-up exams/assessments will be given. Both online and on campus students who know in advance that they will be absent due to school sponsored trips, military duty or orders, or any other valid reason, must arrange to take an early exam/assessment. Unexpected absences due to illness or other extenuating circumstances will require the student to see the instructor about make-up work in lieu of the missed exam/assessment.

E. Students with unexcused absences will be given a zero for each missed assignment.

VI. SEMESTER GRADE COMPUTATION

<table>
<thead>
<tr>
<th>Course Requirements</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework/Quizzes</td>
<td>120</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>180</td>
</tr>
<tr>
<td>Lab Projects</td>
<td>400</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Points</th>
<th>Grade</th>
<th>Quality Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>900-1000</td>
<td>A-Superior</td>
<td>4</td>
</tr>
<tr>
<td>800-899</td>
<td>B-Above Average</td>
<td>3</td>
</tr>
<tr>
<td>700-799</td>
<td>C-Average</td>
<td>2</td>
</tr>
</tbody>
</table>
VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE INSTRUCTOR

A. **Course Withdrawal**: It is the student’s responsibility to officially withdraw from a course if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application for Withdrawal (CTC Form 59). The student must sign the withdrawal form.

CTC Form 59 will be accepted at any time prior to Friday of the 12th week of classes during the 16-week fall and spring semesters. The deadline for sessions of other lengths is:

- 10-week session: Friday of the 8th week
- 8-week session: Friday of the 6th week
- 5-week session: Friday of the 4th week

The equivalent date (75% of the semester) will be used for sessions of other lengths. The specific last day to withdraw is published each semester in the Schedule Bulletin.

For non-GoArmyEd active military students, the effective date of withdrawal is the filing date with the Education Center. For all other students, the effective date of withdrawal is the date that the withdrawal application is received by the Central Texas College representative.

Students who used financial aid, military tuition assistance, VA benefits, or other non-personal funds may be required to repay tuition and fees to the funding agency. For specific repayment requirements, contact the Office of Student Financial Aid or Veterans Services Office before withdrawing. Military tuition assistance students should visit their military Education Center or Navy College Office.

A student who officially withdraws will be awarded the grade of “W” provided the student’s attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the College before they may be considered for withdrawal.

A student may not withdraw from a class for which the instructor has previously issued a grade of “F,” “FI,” “FN,” “IP,” or “XN.”

B. **Instructor Initiated Withdrawals**: Faculty are authorized to withdraw students who are not making satisfactory course progress to include failure to meet College attendance requirements as outlined in the section of the Catalog entitled...
“Satisfactory Progress Standards.” The instructor will assign the appropriate grade on CTC Form 59 for submission to the registrar.

Students enrolled in distance learning courses are expected to maintain constant progress throughout the course. Failure to do so may result in the student being administratively withdrawn by the instructor.

Students who have not attended class by the 12th class day of a 16-week course or the 6th class day of an 8-week term may be administratively withdrawn by the instructor with a grade of "W." Students may be administratively withdrawn from any class when their absences reach a total equal to 12.5% of the class hours for the course; and in the opinion of the instructor, the student cannot satisfactorily complete the course. An example: Students attending a 48-hour class during an 8-week period normally meet 180 minutes each session for 16 sessions. Those students accumulating two (2) unexcused absences are subject to Administrative Withdrawal since the total unexcused absences equal 12.5% of class hours for the course. Those students attending a 48 hour class during a 16-week period normally meet 90 minutes each session for 32 sessions. Those students accumulating four (4) unexcused absences are subject to Administrative Withdrawal since the total unexcused absences equals 12.5% of class hours for the course. In a distance learning course the last date of attendance is the last activity by the student in the course.

C. Administrative Withdrawal: A student may be administratively withdrawn by a designated member of the administrative staff of the College when the student has been placed on Academic Suspension or Disciplinary Suspension; the student has an outstanding financial obligation owed to the college; or the student registered for a course without the required prerequisite or departmental permission.

The College is under no obligation to refund tuition and fees, or other costs associated with an administrative or instructor initiated withdrawal.

D. Incomplete Grade: The College catalog states, “An incomplete grade may be given in those cases where the student has completed the majority of the coursework but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course…” Prior approval from the instructor is required before the grade of “IP” for Incomplete is recorded.

E. Cell Phones and Pagers: Students will silence cell phones and mobile devices while in the classroom or lab.

F. Americans with Disabilities Act (ADA): Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of
Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Review the website at www.ctcd.edu/disability-support for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

G. **Instructor Discretion:** The instructor reserves the right of final decision in course requirements and may make changes to the course outline and/or assignments as needed.

H. **Civility:** Individuals are expected to be aware of what a constructive educational experience is and be respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

I. **Degree Progression:** Students who receive a grade of “D” are advised not to enroll in the next course for which this course was a prerequisite.

J. **Failing Grade:** The grade of “F” or “FN” will be given for academic failure, non-attendance or scholastic dishonesty.

K. **Scholastic Honesty:** All students are expected to maintain the highest standards of scholastic honesty in the preparation of all course work and during examinations. The college policy on scholastic honesty, including definitions on plagiarism, collusion, and cheating can be found at the following URL: http://online.ctcd.edu/plagiarism.cfm
VIII. COURSE OUTLINE

A. Lesson One: Review of Gates, Flip Flops, and Arithmetic circuits

1. Lesson Objectives: Upon successful completion of this Lesson, the student will be able to:
   a. Draw the truth tables for AND, NAND, OR, NOR, Inverters, XOR, and XNOR gates
   b. Demonstrate how D, SR, clocked SR, and JK flip-flops operate
   c. Identify circuit applications for D, SR, clocked SR, and JK flip-flops (shift registers, counters)
   d. Explain the function of Schmitt triggers
   e. Perform basic math functions in binary
   f. Calculate 1’s and 2’s complement math as it applies to binary arithmetic circuits

2. Learning Activities:
   a. Read Chapters 3, 5, 6, and 7 in the textbook paying particular attention to items listed in the Lesson Objectives (C5, C8)
   b. Study the Chapter 7, section 7-5. This is an application of several of the Learning Objectives in a single circuit (C5, C8)
   c. Build a 3-bit synchronous up/down counter (C3, C18, C19, C20, F7, F8, F9, F10, and F15)

3. Lesson Outline:
   Follows the sequence of Lesson Objectives

B. Lesson Two: MSI Logic Circuits

1. Lesson Objectives: Upon successful completion of this Lesson, the student will be able to:
   a. Describe the theory of operation and the circuit limitations of several types of digital-to-analog converters (DACs).
   b. Explain the various DAC manufacturer specifications.
   c. Use different test procedures to troubleshoot DAC circuits.
   d. Compare the advantages and disadvantages of the major analog-to-digital converter (ADC) architectures.
   e. Analyze the process by which a computer, in conjunction with an ADC, digitizes an analog signal and then reconstructs that analog signal from the digital data.
   f. Explain the need for using sample-and-hold circuits in conjunction with ADCs.
   g. Describe the operation of an analog multiplexing system.
   h. Describe the basic concepts of digital signal processing.
   i. Troubleshoot medium scale integrated circuits
2. **Learning Activities:**
   a. Read Chapter 9 in the textbook (C5, C8)
   b. Complete the assigned problems from Chapter 9 (F1, F2, F3, F4, F8, F12, C1, C5, C6, C15, C16, C17, C18, C19, C20)
   c. Study handouts on ADC and DAC circuits (C5, C8)
   d. Construct and analyze the labs assigned (C5, C6, C15, C16, C17, C18, C19, C20)

3. **Lesson Outline:**
   Follows the sequence of Lesson Objectives

C. **Lesson Three: Interfacing with the Analog World**

   1. **Lesson Objectives:** Upon successful completion of this Lesson, the student will be able to:
      a. Analyze and use decoders and encoders in various types of circuit applications
      b. Compare the advantages and disadvantages of LEDs and LCDs
      c. Utilize the observation/analysis technique for troubleshooting digital circuits
      d. Analyze the operation of multiplexers and demultiplexers by circuit applications
      e. Compare two binary numbers by using the magnitude comparator circuit
      f. Describe the function and operation of code converters
      g. Cite the precautions that must be considered when connecting digital circuits using the data bus concept
      h. Troubleshoot multiplexers and demultiplexers

   2. **Learning Activities:**
      a. Read Chapter 11 in the textbook (C5, C8)
      b. Complete the assigned problems from Chapter 11 (F1, F2, F3, F4, F8, F12, C1, C5, C6, C15, C16, C17, C18, C19, and C20)
      c. Construct and analyze the labs assigned (C5, C6, C15, C16, C17, C18, C19, and C20)

   3. **Lesson Outline:**
      Follows the sequence of Lesson Objectives

D. **Lesson Four: Memory Devices**

   1. **Lesson Objectives:** Upon successful completion of this Lesson, the student will be able to:
a. Define terminology associated with memory systems.
b. Describe the difference between read/write memory and read-only memory.
c. Discuss the difference between volatile and nonvolatile memory.
d. Determine the capacity of a memory device from its inputs and outputs.
e. Outline the steps that occur when the CPU reads from or writes to memory.
f. Distinguish among the various types of ROMs and cite some common applications.
g. Describe the organization and operation of static and dynamic RAMs.
h. Compare the relative advantages and disadvantages of EPROM, EEPROM, and flash memory.
i. Combine memory ICs to form memory modules with larger word size and/or capacity.
j. Use the test results on a RAM or ROM system to determine possible faults in the memory system.

2. Learning Activities:
a. Read Chapter 12 in the textbook (C5, C8)
b. Complete the assigned problems from Chapter 12 (F1, F2, F3, F4, F8, F12, C1, C5, C6, C15, C16, C17, C18, C19, and C20)
c. Construct and analyze the labs assigned (C5, C6, C15, C16, C17, C18, C19, and C20)

3. Lesson Outline:
Follows the sequence of Lesson Objectives

E. Lesson Five: Memory Devices: EEPROMS/EPROMS

1. Lesson Objectives: Upon successful completion of this Lesson, the student will be able to:
a. Illustrate how PROM, EPROM, and EEPROM devices operate
b. Demonstrate how to access addresses and use the data in those addresses
c. Program and erase EPROMS and EEPROMS
d. Be able to determine memory requirements and select suitable EEPROMS for use in circuits
e. Build a circuit using an EPROM or EEPROM

2. Learning Activities:
a. View the PowerPoint slides for Lesson Five (C5, C8)
b. Construct and analyze the labs assigned (C5, C6, C15, C16, C17, C18, C19, and C20)

3. Lesson Outline:
Follows the sequence of Lesson Objectives
F. Lesson Six: Final Project/Exam

1. Lesson Objectives: Upon successful completion of this Lesson, the student will be able to:
   a. Integrate learning from CETT1425 and this course to design, construct, and troubleshoot a digital system
   b. Work as a team member to construct a circuit

2. Learning Activities:
   Construct a circuit of the students own design (C3, C4, C5, C6, C7, C8, C9, C10, C12, C13, C14, C15, C16, C17, C18, C19, F1, F2, F3, F5, F6, F8, F9, F10, F13, F15, F16)

3. Lesson Outline:
   Follows the sequence of Lesson Objectives