I. INTRODUCTION

A. A study of diodes, transistor characteristics and other semiconductor devices, including analysis of static and dynamic characteristics, biasing techniques, and thermal considerations.

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/Co-requisite: CETT 1305 AC Circuits.

II. LEARNING OUTCOMES

Upon successful completion of this course, Solid State Devices, the student will be able to:

A. Analyze various solid state devices and circuits. (C6, C8, C15, C19, F1, F2, F3, F9)

B. Construct circuits to test. (C15, C18, C19, F10)

C. Troubleshoot various solid state devices. (C5, C15, C16, C18, C19, C20, F1, F2, F3, F9)

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 capable of performing logarithmic functions, roots, and powers.

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

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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:
   - Quizzes
   - Midterm Assessment (Diodes Exam)
   - Labs
   - Final Exam (Comprehensive)*
   *Students must pass the Final in order to pass the course!

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.

F. Students must pass the final exam to receive a passing grade for the course.
VI. SEMESTER GRADE COMPUTATIONS

<table>
<thead>
<tr>
<th>Course Requirements</th>
<th>Points</th>
<th>Points Range</th>
<th>Grade</th>
<th>Quality Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quizzes</td>
<td>250</td>
<td>900-1000</td>
<td>A-Superior</td>
<td>4</td>
</tr>
<tr>
<td>Midterm Assessment(Diode)</td>
<td>200</td>
<td>800-899</td>
<td>B-Above Average</td>
<td>3</td>
</tr>
<tr>
<td>Labs</td>
<td>300</td>
<td>700-799</td>
<td>C-Average</td>
<td>2</td>
</tr>
<tr>
<td>Final Assessment* must pass to pass the course</td>
<td>250</td>
<td>600 - 699</td>
<td>D – Passing but Unsatisfactory</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1000</td>
<td>0 - 599</td>
<td>F-Failure</td>
<td>0</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](http://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](http://online.ctcd.edu/plagiarism.cfm)
VIII. COURSE OUTLINE

A. **Lesson One: Introduction to Semiconductors.**

1. **Learning Outcomes:** Upon successful completion of this lesson the student will be able to describe:
   a. Atomic Structure
   b. Semiconductors, conductors, and insulators.
   c. Current in Semiconductors
   d. N-Type and P-Type Semiconductors
   e. The diode
   f. Biasing the diode
   g. Voltage and current characteristics of a diode.
   h. Diode Models
   i. Testing a diode.
   j. Application in solar power

2. **Learning Activities**
   a. Classroom Lecture/Discussion (F5, F6)
   b. PowerPoint Presentation for Lecture One. (F1)
   c. Reading Assignment: Chapter 1 (F1)
   d. Homework – Problems, Chapter 1 (F2)

3. **Lesson Outline:**
   Follows the order of Learning Outcomes

B. **Lesson Two: Diodes and Applications**

1. **Learning Outcomes:** Upon successful completion of this lesson the student will be able to:
   a. Describe forward bias and reverse bias of a diode.
   b. Understand performance variations between different rectifier types.
   c. Know how reverse current is created in a diode and how breakdown occurs.
   d. Analyze, construct, and troubleshoot Half-Wave, Full-Wave, and Bridge Rectifier circuits.
   e. Understand how various diode configurations can form logic gates.
   f. Know how filters and regulators work with rectifiers.
   g. Interpret diode datasheets
   h. Describe how clippers, clampers, and voltage multipliers function.

2. **Learning Activities:**
   a. Classroom Lecture/Discussion (F5, F6)
   b. Reading Assignment: Chapter 2 (F1)
c. Review the PowerPoint slides for the lesson. (F1)
d. Complete any assigned homework. (F4)
e. Perform assigned Lab Experiments (C8, C9, C15, C18, C19, and C20, F1, F2, F3, F8, F9, F10)
f. Practice troubleshooting techniques using provided troubleshooting boards. (C8, C9, C15, C18, C19, and C20, F1, F2, F3, F8, F9, F10)

3. Lesson Outline:
   Follows the order of Learning Outcomes

C. Lesson Three: Special Purpose Diodes

1. Learning Outcomes: Upon successful completion of this lesson the student will be able to:
   a. Understand the operation and use of Zener diodes
   b. Describe optical diodes and applications.
   c. Describe Schottky diodes and their uses.
   d. Describe varactors and their function in tuning circuits.
   e. Discuss the operation of current regulating diodes, PIN diodes, Tunnel diodes and laser diodes.
   f. Apply knowledge from previous learning outcomes to analyze the operation of a regulated DC power supply.

2. Learning Activities:
   a. Classroom Lecture/Discussion (F5, F6)
   b. View the PowerPoint presentation for Lesson Three. (F1)
   c. Reading Assignment: Chapter 3 (F1)
   d. Complete the assigned homework problems Ch 3. (F4)
   e. Practice troubleshooting techniques using the provided troubleshooting boards. (C8, C9, C15, C18, C19, and C20, F1, F2, F3, F8, F9, F10)

3. Lesson Outline:
   Follows the order of Learning Outcomes

D. Lesson Four: Bipolar Junction Transistors

1. Learning Outcomes: Upon successful completion of this lesson the student will be able to:
   a. Explain transistor operation
   b. Explain how a transistor a works as an amplifier a switch
   c. Identify and explain the operating characteristics of common-base circuits
   d. Identify and explain the operating characteristics of common-emitter circuits
   e. Identify and explain the operating characteristics of common-collector
circuits
f. Test a transistor for proper operation using a multimeter and Curve Tracer

2. Learning Activities:
   a. Classroom Lecture/Discussion. (F5, F6)
   b. Reading Assignment. (F1)
      1) Chapter 4
      2) Assigned lab exercise.
   c. View the PowerPoint slides for Lesson Four. (F1)
   d. Do the homework assigned for Chapter 4 (F4)
   e. Perform the laboratory experiments assigned. (C8, C9, C15, C18, C19,
      C20, F1, F2, F3, F8, F9, F10)

3. Lesson Outline:
   Follows the order of Learning Outcomes

E. Lesson Five: Bipolar Transistor Bias Circuits

1. Learning Outcomes: Upon successful completion of this lesson the student will be able to identify:
   a. Understand the DC operating point of a transistor.
   b. Describe voltage divider bias
   c. Identify alternate methods of circuit biasing
   d. Know how linear regulation functions in a transistor
   e. Be able to troubleshoot and repair amplifiers
   f. Determine the AC and DC load lines of a transistor circuit

2. Learning Activities:
   a. Classroom Lecture/Discussion (F5, F6)
   b. Reading Assignment (F1)
      1). Read Chapter 5
      2). Lab Experiments 9 through 16
   c. Review the PowerPoint slides for the lesson (F1)
   d. Practice troubleshooting techniques using the provided troubleshooting boards. (C8, C9, C15, C18, C19, and C20, F1, F2, F3, F8, F9, F10)

3. Lesson Outline:
   Follows the order of Learning Outcomes

F. Lesson Six: BJT Amplifiers

1. Learning Outcomes: Upon successful completion of this lesson the student will be able to identify:
a. Understand basic amplifier operation
b. Model the flow of AC in a transistor amplifier
c. Identify the operating characteristics of a common-emitter amplifier
d. Identify the operating characteristics of a common-collector amplifier
e. Identify the operating characteristics of a common-base amplifier
f. Know how multi-stage amplifiers function
g. Be able to troubleshoot and repair BJT amplifiers

2. Learning Activities:
   a. Classroom Lecture/Discussion (F5, F6)
   b. Reading Assignment (F1)
      1). Read Chapter 6
      2). Perform the assigned lab experiments
   c. Review the PowerPoint slides for the lesson (F1)
   d. Practice troubleshooting techniques using the provided troubleshooting boards. (C8, C9, C15, C18, C19, and C20, F1, F2, F3, F8, F9, F10)

3. Lesson Outline:
   Follows the order of Learning Outcomes