CENTRAL TEXAS COLLEGE
CETT 1303
DC CIRCUITS

Semester Hours Credit: 3

INSTRUCTOR: _________________________
OFFICE HOURS: _______________________

I. INTRODUCTION

A. A study of the fundamentals of direct current including Ohm's law, Kirchhoff's laws and circuit analysis techniques.

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. Prerequisites: None

II. LEARNING OUTCOMES

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

A. Apply safety techniques while working on and troubleshooting various circuits and components (C15, C16, C18)
B. Interpret color codes and other descriptors used in electronics (C5, F1, F2, F3).
C. Identify various sources of electricity in DC circuits (C5, C15, C19, F1,F10)
D. Interpret characteristics of voltage, current, resistance, and power in parallel and series DC circuits (C1, C5, F1, F2, F3, F5, F10)
E. Measure voltage, current, and resistance in DC circuits using measuring devices (C1, C5, C6, C15, C16, C18, C19, )
F. Apply Kirchhoff’s Law to DC circuits (C1, C5, F1, F2, F3, F5, F10)
G. Determine equivalent circuits using Thevenin’s Theorem and Norton’s Theorem (C1, C5, F1, F2, F3, F5, F10)
III. INSTRUCTIONAL MATERIALS

A. The instructional materials identified for this course are viewable through [www.ctcd.edu/books](http://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 7”x 7”.

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, Projects
   - Assessments (midterm exam, quizzes, projects, etc.)
   - 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
### Course Requirements

<table>
<thead>
<tr>
<th>Course Requirements</th>
<th>Points</th>
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<tbody>
<tr>
<td>Homework/Quizzes</td>
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<tr>
<td>Midterm Exam</td>
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<td>Final Exam</td>
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<tr>
<td>Lab Experiments</td>
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<td><strong>TOTAL</strong></td>
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<table>
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<tr>
<th>Points</th>
<th>Grade</th>
<th>Quality Points</th>
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<tbody>
<tr>
<td>900-1000</td>
<td>A-Superior</td>
<td>4</td>
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<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>
<tr>
<td>600 - 699</td>
<td>D – Passing but Unsatisfactory</td>
<td>1</td>
</tr>
<tr>
<td>0 - 599</td>
<td>F-Failure</td>
<td>0</td>
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</tbody>
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### 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 withdrawal.
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 Powers of 10

1. **Learning Outcomes:** Upon successful completion of this lesson the student will be able to:
   a. Express any number in scientific or engineering notation
   b. List the metric prefixes and their corresponding powers of 10
   c. Change a power of 10 in engineering notation to its corresponding metric prefix
   d. Convert between metric prefixes
   e. Add and subtract numbers expressed in powers of 10 notation and divide numbers expressed in powers of 10 notation
   f. Find the square of a number expressed in powers of 10 notation
   g. Find the square root of a number expressed in powers of 10 notation
   h. Enter numbers written in scientific and engineering notation into your calculator

2. **Learning Activities:**
   a. Research and discuss the topics of the Lesson in class and in an online collaborative discussion forum (F3, F5, F6)
   b. Answer problems as assigned. (C15, C18, F1, F2, F3, F4, F9)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

B. Lesson Two: Electricity

1. **Unit Objectives:** Upon successful completion of this lesson the student will be able to:
   a. List the two basic particles of electric charge
   b. Describe the basic structure of the atom
   c. Define the terms conductor, insulator, and semiconductor and give examples of each
   d. Define the coulomb unit of electric charge
   e. Define potential difference and voltage and list the unit of each
   f. Define current and list its unit of measure
   g. Describe the difference between voltage and current
   h. Define resistance and conductance and list the unit of each
   i. List three important characteristics of an electric circuit
   j. Define the difference between electron flow and conventional current
   k. Describe the difference between direct and alternating current

2. **Learning Activities:**
   a. Classroom Lecture/Discussion (C5, C6, F1, F2, F3, F5)
b. Reading Assignment: Chapter One of the textbook. (F3, F5, F6)
c. Perform experiments as directed by the instructor. (C1, C5, C6, C7, C8, C15, C16, C18, C19, C20, F1, F2, F3)
d. Homework - Work problems at end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
e. Take the chapter self-test. (C1, C5, C6, C15, F1, F2, F3)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

C. **Lesson Three: Resistors**

1. **Unit Objectives:** Upon successful completion of this lesson the student will be able to:
   a. List several different types of resistors and describe the characteristics of each type
   b. Interpret the resistor color code to determine the resistance and tolerance of a resistor
   c. Explain the difference between a potentiometer and a rheostat
   d. Explain the significance of a resistor’s power rating
   e. List the most common troubles with resistors
   f. Explain the precautions that must be observed when measuring a resistor with an ohmmeter

2. **Learning Activities:**
   a. Classroom Lecture/Discussion (C5, C6, F1, F2, F3, F5)
   b. Reading Assignment: Read Chapter Two of the textbook. (F3, F5, F6)
   c. Complete problems at end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
   d. Take the chapter self-test. (C1, C5, C6, C15, F1, F2, F3)
   e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

D. **Lesson Four: Ohm’s Law**

1. **Unit Objectives:** Upon successful completion of this lesson the student will be able to:
   a. List the three forms of Ohm’s law.
   b. Use Ohm’s law to calculate the current, voltage, or resistance in a circuit.
   c. List the multiple and submultiple units of voltage, current, and resistance.
   d. Explain the difference between a linear and a nonlinear resistance.
   e. Explain the difference between work and power and list the units of
each.
f. Calculate the power in a circuit when the voltage and current, current and resistance, or voltage and resistance are known.
g. Determine the required resistance and appropriate wattage rating of a resistor.
h. Identify the shock hazards associated with working with electricity.
i. Explain the difference between an open circuit and short circuit.

2. **Learning Activities:**
   a. Classroom Lecture/Discussion (C5, C6, F1, F2, F3, F5)
   b. Reading Assignment: Read Chapter Three of the textbook. (F3, F5, F6)
   c. Complete problems at the end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
   d. Take the chapter self-test. (C1, C5, C6, C15, F1, F2, F3)
   e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

**E. Lesson Five: Series Circuits**

1. **Unit Objectives:** Upon successful completion of this lesson the student will be able to:
   a. Explain why the current is the same in all parts of a series circuit.
   b. Calculate the total resistance of a series circuit.
   c. Calculate the current in a series circuit.
   d. Determine the individual resistor voltage drops in a series circuit.
   e. Apply Kirchhoff’s voltage law to series circuits.
   f. Determine the polarity of a resistor’s IR voltage drop.
   g. Calculate the total power dissipated in a series circuit.
   h. Determine the net voltage of series-aiding and series-opposing voltage sources.
   i. Solve for the voltage, current, resistance, and power in a series circuit having random unknowns.
   j. Define the terms earth ground and chassis ground.
   k. Calculate the voltage at a given point with respect to ground in a series circuit.
   l. Describe the effect of an open in a series circuit.
   m. Describe the effect of a short in a series circuit.
   n. Troubleshoot series circuits containing opens and shorts.

2. **Learning Activities:**
   a. Classroom Lectures/Discussion. (C5, C6, F1, F2, F3, F5)
   b. Reading Assignment: Chapter Four in the textbook. (F3, F5, F6)
c. Complete problems at the end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
d. Take the chapter self-test. (C1, C5, C6, C15, F1, F2, F3)
e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

F. **Lesson Six: Parallel Circuits**

1. **Unit Objectives:** Upon successful completion of this lesson the student will be able to:
   a. Explain why voltage is the same across all branches in a parallel circuit.
   b. Calculate the individual branch currents in a parallel circuit.
   c. Calculate the total current in a parallel circuit using Kirchhoff’s current law.
   d. Calculate the equivalent resistance of two or more resistors in parallel.
   e. Explain why the equivalent resistance of a parallel circuit is always less than the smallest branch resistance.
   f. Calculate the total conductance of a parallel circuit.
   g. Calculate the total power in a parallel circuit.
   h. Solve for the voltage, current, power, and resistance in a parallel circuit having random unknowns.
   i. Describe the effects of an open and short in a parallel circuit.
   j. Troubleshoot parallel circuits containing opens and shorts.

2. **Learning Activities:**
   a. Classroom Lectures/Discussion. (C5, C6, F1, F2, F3, F5)
   b. Reading Assignment: Chapter Five in the textbook. (F3, F5, F6)
   c. Complete the problems at end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
   d. Take the chapter self-test. (C1, C5, C6, C15, F1, F2, F3)
   e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

G. **Lesson Seven: Series-Parallel Circuits**

1. **Unit Objectives:** Upon successful completion of this lesson the student will be able to:
   a. Determine the total resistance of a series-parallel circuit.
   b. Calculate the voltage, current, resistance, and power in a series-
parallel circuit.
c. Calculate the voltage, current, resistance, and power in a series-parallel circuit having random unknowns.
d. Explain how a Wheatstone bridge can be used to determine the value of an unknown resistor.
e. List other applications of balanced bridge circuits.
f. Describe the effects of opens and shorts in series-parallel circuits.
g. Troubleshoot series-parallel circuits containing opens and shorts.

2. Learning Activities:
a. Classroom Lectures/Discussion. (C5, C6, F1, F2, F3, F5)
b. Reading Assignment: Chapter Six in the textbook. (F3, F5, F6)
c. Homework: Work problems at end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
d. Take the chapter self-test. (C1, C5, C6, C15, F1, F2, F3)
e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. Unit Outline: Follow the sequence of Lesson Objectives.

H. Lesson Eight: Voltage Dividers and Current Dividers

1. Unit Objectives: Upon successful completion of this lesson the student will be able to:
a. Calculate the voltage drops in an unloaded voltage divider.
b. Explain why resistor voltage drops are proportional to the resistor values in a series circuit.
c. Calculate the branch currents in a parallel circuit.
d. Explain why the branch currents are inversely proportional to the branch resistances in a parallel circuit.
e. Define what is meant by the term loaded voltage divider.
f. Calculate the voltage, current, and power values in a loaded voltage divider.

2. Learning Activities:
a. Classroom Lectures/Discussion. (C5, C6, F1, F2, F3, F5)
b. Reading Assignment: Chapter Seven in the textbook. (F3, F5, F6)
c. Complete problems at the end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
d. Take the chapter self-test. (C1, C5, C6, C15, F1, F2, F3)
e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. Unit Outline: Follow the sequence of Lesson Objectives.
I. **Lesson Nine: Kirchhoff’s Laws**

1. **Unit Objectives:** Upon successful completion of this lesson the student will be able to:
   a. State Kirchhoff’s current law.
   b. State Kirchhoff’s voltage law.
   c. Use the method of branch currents to solve for all voltages and currents in a circuit containing two or more voltage sources in different branches.
   d. Use node-voltage analysis to solve for the unknown voltages and currents in a circuit containing two or more voltage sources in different branches.
   e. Use the method of mesh currents to solve for the unknown voltages and currents in a circuit containing two or more voltage sources in different branches.

2. **Learning Activities:**
   a. Classroom Lectures/Discussion. (C5, C6, F1, F2, F3, F5)
   b. Reading Assignment: Chapter Nine in the textbook. (F3, F5, F6)
   c. Complete the problems at the end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
   d. Take the chapter self-test (C1, C5, C6, C15, F1, F2, F3)
   e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

J. **Lesson Ten: Network Theorems**

1. **Unit Objectives:** Upon successful completion of this lesson, the student will be able to:
   a. Apply the superposition theorem to find the voltage across two points in a circuit containing more than one voltage source.
   b. State the requirements for applying the superposition theorem.
   c. Determine the Thevenin and Norton equivalent circuits with respect to any pair of terminals in a complex network.
   d. Apply Thevinin’s and Norton’s theorems in solving for an unknown voltage or current.
   e. Convert a Thevenin equivalent circuit to a Norton equivalent circuit and vice versa.

2. **Learning Activities:**
   a. Classroom Lectures/Discussion. (C5, C6, F1, F2, F3, F5)
   b. Reading Assignment: Chapter Ten in the textbook. (F3, F5, F6)
c. Complete the problems at the end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
d. Take the chapter self-test (C1, C5, C6, C15, F1, F2, F3)
e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

K. **Lesson 11: Conductors and Insulators**

1. **Unit Objectives:** Upon successful completion of this lesson, the student will be able to:
   a. Explain the main function of a conductor in an electric circuit.
   b. Calculate the cross-sectional area of round wire when the diameter is known.
   c. List the advantages of using stranded wire versus solid wire.
   d. List common types of connectors used with wire conductors.
   e. Define the terms pole and throw as they relate to switches.
   f. Explain how fast-acting and slow-blow fuses differ.
   g. Calculate the resistance of a wire conductor whose length, cross-sectional area, and specific resistance are known.
   h. Explain the meaning of temperature coefficient of resistance.
   i. Explain ion current and electron current.
   j. Explain why insulators are sometimes called dielectrics.
   k. Explain what is meant by the corona effect.

2. **Learning Activities:**
   a. Classroom Lectures/Discussion. (C5, C6, F1, F2, F3, F5)
   b. Reading Assignment: Chapter Eleven in the textbook. (F3, F5, F6)
   c. Complete the problems at the end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
   d. Take the chapter self-test (C1, C5, C6, C15, F1, F2, F3)
   e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. **Unit Outline:** Follow the sequence of Lesson Objectives.

L. **Lesson 12: Batteries**

1. **Unit Objectives:** Upon successful completion of this lesson, the student will be able to:
   a. Explain the difference between primary and secondary cells.
   b. Define what is meant by the internal resistance of a cell.
   c. List several different types of voltaic cells.
d. Explain how cells can be connected to increase either the current capacity or voltage output of a battery.

e. Explain why the terminal voltage of a battery drops with more load current.

f. Explain the difference between voltage sources and current sources.

g. Explain the concept of maximum power transfer.

2. Learning Activities:
   a. Classroom Lectures/Discussion. (C5, C6, F1, F2, F3, F5)
   b. Reading Assignment: Chapter Eleven in the textbook. (F3, F5, F6)
   c. Complete the problems at the end of the chapter. (C15, C18, F1, F2, F3, F4, F9)
   d. Take the chapter self-test (C1, C5, C6, C15, F1, F2, F3)
   e. Complete lab exercises as assigned. (C1, C3, C5, C6, C7, C15, C16, C20, F1, F2, F3, F8, F9, F10, F16)

3. Unit Outline: Follow the sequence of Lesson Objectives.