Mercer County Community College

Division of Business and Technology

EET 138

Introduction to Electronics I

COURSE DESCRIPTION

The course will focus on DC devices and circuits. Starting with the fundamentals of electricity, Ohm's law, Kirchoff's law, series and parallel circuits, the students will then learn about resistors, capacitors, inductors, batteries, transistors and diodes as they pertain to DC circuits.

Text (s): Introductory DC/AC Electronics
Author: Nigel Cook
Prentice Hall Publisher

Prerequisites: MAT110 or Equivalent

Credits: 4 **Lecture Hours: 3** **Studio/Lab Hours: 3**

Food and drink are strictly prohibited in classrooms as per health and safety laws. Students may not bring in chemicals or cleaning fluids without the appropriate MSD sheets

Course Coordinator: Dominick DeFino **Latest Review: Spring 2004**

I. LABORATORY

The lab, experiences will reinforce and augment the classroom work Students will use analog and digital meters to measure voltage and current as well as ohmmeters to measure resistance.

Some of the lab time will be spent on the computer experiencing programs such as: BASIC, PSPICE, and EXCEL.

The lab grade will be based on a lab worksheet to be handed in when each lab experiment is completed.

II. GRADING

There will be a mid term and final test as well as weekly quizzes combined with a lab grade to determine the course grade.

III. COURSE OBJECTIVE:

This will be the first of a two sequence set of courses to prepare students for sophomore level courses in the EET curriculum. The student will be able to read digital and analog meters, wire and make measurements on DC circuits containing resistors, capacitors, inductors, diodes and transistors.

IV. COMPETENCY:

A passing grade of "C" or better will indicate that the student has achieved a level sufficient to move onto EET139 the second part of this sequence.

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TOPIC OUTLINE

WEEK	CHAPTER
1	2.1-2.3
2	2.4-2.6 3.1-3.2
3	3.3-3.4 4.1-4.6
4	6.1-6.4
5	7.1-7.4
6	7.4-7.6
7	8.1-8.6
8	9.1-9.5 - TEST 1
9	12.1-12.7
10	12.8-12.10
11	14.1-14.2 15.1-15.4 - Solenoids, relays, buzzers, bells
12	15.5-15.6 - The PN junction, diodes, rectifiers, photo diodes
13	Transistors: bipolar, FET, biasing
14	DC amplifiers, transistor switching, high voltage generator
15	SCR's and Triac's - TEST 2

TEXTBOOK READING

Week 1 & 2

Chapter 2: Voltage and Current

Home Work:
Multiple Choice Questions
1-20 and Practice Problems
31-38, 40

2-1 The Structure of Matter
- 2-1-1 The Atom
- 2-1-2 Laws of Attraction and Repulsion
- 2-1-3 The Molecule

Scientific notation, sub and multiple units

2-2 Current
- 2-2-1 Coulombs per Second
- 2-2-2 The Ampere
- 2-2-3 Units of Current
- 2-2-4 The Speed of Current Flow
- 2-2-5 Conventional versus Electron Flow
- 2-2-6 How is Current Measured?

Analog and Digital Meters

2-3 Voltage
- 2-3-1 Symbols
- 2-3-2 Units of Voltage
- 2-3-3 How Is Voltage Measured?
- 2-3-4 Fluid Analogy of Current and Voltage
- 2-3-5 Current Is Directly Proportional to Voltage

2-4 Conductors
- 2-4-1 Conductance

2-5 Insulators

2-6 The Open, Closed, and Short Circuit
- 2-6-1 Open Circuit (Open Switch)
- 2-6-2 Open Circuit (Open Component)
- 2-6-3 Closed Circuit (Closed Switch)
- 2-6-4 Short Circuit (Shorted Component)

Week 2 & 3

Chapter 3 Resistance and Power

Homework:
M.C.Q.s 1-15
P.P. 41-60

3-1 What is Resistance?

3-2 The Ohm
- 3-2-1 Ohm's Law
- 3-2-2 The Ohm's Law Triangle
- 3-2-3 Current is Proportional to Voltage
- 3-2-4 Current is Inversely Proportional to Resistance

3-3 Conductors and Their Resistance
- 3-3-1 Conducting Material
- 3-3-2 Conductor's Cross-Sectional Area
- 3-3-3 Conductor Length
- 3-3-4 Physical Resistance Formula
- 3-3-5 Temperature Effects on Conductors
- 3-3-6 Maximum Conductor Current
- 3-3-7 Superconductivity
- 3-3-8 Conductor and Connector Types

Week 2 & 3 (cont'd)

3-4 Energy, Work, and Power
- 3-4-1 Power
- 3-4-2 Calculating Energy
- 3-4-3 Calculating Power
- 3-4-4 Measuring Power
- 3-4-5 The Kilowatt-Hour

Week 4

Chapter 4: Resistors — **Homework:** M.C. 1-20, P.P. 36-40

4-1 Resistors
- 4-1-1 Fixed-Value Resistors
- 4-1-2 Variable-Value Resistors

4-2 How is Resistance Measured?

4-3 Resistor Coding
- 4-3-1 General-Purpose and Precision Color Code
- 4-3-2 Zero-Ohms Resistor
- 4-3-3 Other Resistor Identification Methods

4-4 Power Dissipation Due to Resistance

4-5 Filament Resistors

4-6 Testing Resistors

Week 4 & 5

Chapter 6: Direct Current (DC) — **Homework:** M.C. 1-15, P.P. 26-30

6-1 Source and Load

6-2 Direct-Current Sources
- 6-2-1 Mechanical Generated DC: Mechanical→Electrical
- 6-2-2 Thermally Generated DC: Heat→Electrical
- 6-2-3 Optically Generated DC: Light→Electrical
- 6-2-4 Magnetically Generated DC: Magnetic→Electrical
- 6-2-5 Chemically Generated DC: Chemical→Electrical
- 6-2-6 Electrically Generated DC

6-3 Equipment Protection
- 6-3-1 Fuses
- 6-3-2 Circuit Breakers

6-4 Switches

Week 6

Chapter 7: Series DC Circuits — **Homework:** M.C. 1-15, P.P. 27-35

7-1 Components in Series

7-2 Current in a Series Current

7-3 Resistance in a Series Current

7-4 Voltage in a Series Current
- 7-4-1 A Voltage Source's Internal Resistance
- 7-4-2 Fixed Voltage Divider
- 7-4-3 Variable Voltage Divider

7-5 Power in a Series Circuit
- 7-5-1 Maximum Power Transfer

7-6 Troubleshooting a Series Circuit
- 7-6-1 Open Component in a Series Circuit
- 7-6-2 Component Value Variation in a Series Circuit
- 7-6-3 Shorted Component in a Series Circuit

Week 7

Chapter 8: Parallel DC Circuits **Homework:**

M.C. 1-10
P.P. 21-35

8-1 Components in Parallel
8-2 Voltage in a Parallel Circuit
8-3 Current in a Parallel Circuit
8-4 Resistance in a Parallel Circuit
- 8-4-1 Two Resistors in Parallel
- 8-4-2 Equal-Value Resistors in Parallel

8-5 Power in a Parallel Circuit
8-6 Troubleshooting a Parallel Circuit
- 8-6-1 Open Component in a Parallel Circuit
- 8-6-2 Shorted Component in a Parallel Circuit
- 8-6-3 Component Value Variation in a Parallel Circuit
- 8-6-4 Summary of Parallel Circuit Troubleshooting

Week 8

Chapter 9: Series-Parallel DC Circuits **Homework:**

M.C. 1-20
P.P. 36-45

9-1 Series-and Parallel-Connected Components 9-2 Total Resistance in a Series-Parallel Circuit
9-3 Voltage Division in a Series-Parallel Circuit
9-4 Branch Currents in a Series-Parallel Circuit
9-5 Power in a Series-Parallel Circuit
9-6 Five-Step Method for Series-Parallel Circuit Analysis
9-7 Series-Parallel Circuits
- 9-7-1 Loading of Voltage-Divider Circuits
- 9-7-2 The Wheatstone Bridge
- 9-7-3 The R-2R Ladder Circuit

9-8 Troubleshooting Series-Parallel Circuits
- 9-8-1 Open Component
- 9-8-2 Shorted Component
- 9-8-3 Resistor Value Variation

9-9 Theorems for DC Circuits
- 9-9-1 Voltage and Current Sources
- 9-9-2 Superposition Theorem
- 9-9-3 Thevenin's Theorem
- 9-9-4 Norton's Theorem

Week 9

Chapter 12: Capacitance and Capacitors **Homework:**

M.C. 1-20
P.P. 40-50

12-1 Capacitor Construction
12-2 Charging and Discharging a Capacitor
- 12-2-1 Charging a Capacitor
- 12-2-2 Discharging a Capacitor

12-3 Electrostatics
12-4 The Unit of Capacitance

Week 9 (cont'd)

12-5 Factors Determining Capacitance
- 12-5-1 Plate Area (A)
- 12-5-2 Distance between the Plates (d)
- 12-5-3 Dielectric Constant
- 12-5-4 The Capacitance Formula

12-6 Dielectric Breakdown and Leakage

12-7 Capacitors in Combination
- 12-7-1 Capacitors in Parallel
- 12-7-2 Capacitors in Series

12-8 Types of Capacitors
- 12-8-1 Fixed-Value Capacitors
- 12-8-2 Variable-Value Capacitors
- 12-8-3 The One-Farad Capacitor

12-9 Coding of Capacitance Values
- 12-9-1 Alphanumeric Labels
- 12-9-2 Color Coding

12-10 Capacitive Time Constant
- 12-10-1 DC Charging
- 12-10-2 DC Discharging

Week 10

Chapter 14

Electromagnetism and Electromagnetic Induction

Homework:
M.C. 1-34
P.P. 56-65

14-1 Electromagnetism
- 14-1-1 Atomic Theory of Electromagnetism
- 14-1-2 DC, AC, and the Electromagnet
- 14-1-3 Magnetic Terms
- 14-1-4 Flux Density (B) versus Magnetizing Force (H)
- 14-1-5 Applications of Electromagnetism

14-2 Electromagnetic Induction
- 14-2-1 Faraday's Law
- 14-2-2 Lenz's Law
- 14-2-3 The Weber
- 14-2-4 Applications of Electromagnetic Induction

Week 11

Chapter 15

Inductance and Inductors

Homework
M.C. 1-12
P.P. 36-42

15-1 Self-Induction

15-2 The Inductor

15-3 Factors Determining Inductance
- 15-3-1 Number of Turns (N)
- 15-3-2 Area of Coil (A)
- 15-3-3 Length of Coil (l)
- 15-3-4 Core Material (μ)
- 15-3-5 Formula for Inductance

15-4 Inductors in Combination
- 15-4-1 Inductors in Series
- 15-4-2 Inductors in Parallel

Week 11 (cont'd)
15-5 Types of Inductors
- 15-5-1 Fixed-Value Inductors
- 15-5-2 Variable-Value Inductors

15-6 Inductive Time Constant
- 15-6-1 DC Current Rise
- 15-6-2 DC Current Fall

Week 12
Chapter 18 Semiconductor Principles

18-1 Semiconductor Devices versus Vacuum Tube Devices
- 18-1-1 Vacuum Tube Devices
- 18-1-2 Solid State Devices

18-2 Semiconductor Materials
- 18-2-1 Semiconductor Atoms
- 18-2-2 Crystals and Covalent Bonding
- 18-2-3 Energy Gaps and Energy Levels
- 18-2-4 Temperature Effects on Semiconductor Materials
- 18-2-5 Applying a Voltage Across a Semiconductor

Week 13
Diodes and Transistors

Week 14
Bipolar Transistor Biasing and DC Amplifier

Week 15
Transistor as a power switch