

Advanced AC and DC Circuits

Course Description:

This foundational course is designed for students interested in careers related to the design, production, analysis, repair, and operation of devices that use electronics. The course is built around major individual and class projects that promote critical thinking, real-world problem-solving, and abstract reasoning. Students will create artifacts that demonstrate their application of competencies in technical, academic, cognitive, and personal skills through daily work, teamwork, homework, formative, and summative assessments.

Classroom Procedures:

Entering the Classroom:

- Enter the classroom quietly take out your composition notebook and record the days Learning Target, Essential Question, and Agenda. ***(No food, drinks, or phones)***.
- Gather necessary materials for the days lesson and hang all bags on the back of the chair that you are occupying. ***(Specific materials will be highlighted on the Energy Systems White Board)***.
- Begin work on opening exercise quietly.

Exiting the Classroom:

- Secure all classroom equipment and place in assigned area.
- Ensure that your area is clean and clear before leaving. ***(This includes computer workstations that you were utilizing or other assigned spaces)***.
- Turn-in classroom assignments to appropriate physical or digital drop box.
- Return to your assigned seat until the bell rings and you are dismissed by the instructor.

Disciplinary Actions: *The order and type of consequences depend on the nature and severity of the infraction.*

- Verbal Warning
- Lunch Detention and phone call home. *(Minor Infractions)*.
- Counselor Referral.
- Discipline Referral. *(Major and Chronic Disciplinary Infractions)*.

Course Standards:

Standard 1: Employability Skills

- 1.1: Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.
- 1.2: Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.
- 1.3: Exhibit critical thinking and problem-solving skills to locate, analyze, and apply information in career planning and employment situations.
- 1.4: Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.
- 1.5: Apply appropriate skill sets to be productive in a changing, technological, diverse workplace.
- 1.6: Present a professional image through appearance, behavior, and language.

Standard 2: Engineering and Electronic Specializations

- 2.1: Design a project conveying information about electronic specializations.
- 2.2: Participate in activities related to career interests.
- 2.3: Relate engineering and electronic disciplines to a green environment and sustainability.
- 2.4: Develop solutions to an ethical issue in engineering and electronic specialization.
- 2.5: Analyze an ethical situation related to engineering graphics and engineering.
- 2.6: Maintain a journal that relates standards in the course to project work.

Standard 3: Safety, Health, and Environmental Standards

- 3.1: Implement workplace and product safety standards.
- 3.2: Interpret safety signs, symbols, and labels.
- 3.3: Demonstrate and incorporate safe laboratory procedures.
- 3.4: Explain the economic impact of safety practices in business and industry.
- 3.5: Use appropriate Personal Protective Equipment (PPE) and follow work area organization procedures.

Standard 4: Analog Circuits

- 4.1: Discuss the history of analog circuits.
- 4.2: Apply analog circuits.
- 4.3: Identify and describe patterns of analog signals.
- 4.4: Evaluate the advantages and disadvantages of analog signaling.
- 4.5: Predict the future of analog electronics.

Standard 5: Amplifiers

- 5.1: Define and discuss power supplies.
- 5.2: Sketch, draw, and construct a power supply circuit.

- 5.3: Define and discuss different types of transistors (BJT and MOS).
- 5.4: Define and discuss different types of amplifiers (Class A, B, D).
- 5.5: Demonstrate negative feedback differential amplifiers.
- 5.6: Conduct analysis and troubleshooting.

Standard 6: Oscillators

- 6.1: Discuss oscillator characteristics related to positive feedback and unity gain.
- 6.2: Define and discuss analog crystal oscillator circuits.
- 6.3: Define and discuss digital oscillator circuits (comparators, latches).
- 6.4: Conduct analysis and troubleshooting.
- 6.5: Create a project to demonstrate knowledge of oscillator applications.

Standard 7: Communication Circuits

- 7.1: Distinguish, contrast, and compare analog and digital signals.
- 7.2: Identify and describe modulation and demodulation.
- 7.3: Demonstrate and apply simple receivers.
- 7.4: Define and discuss super heterodyne receivers.
- 7.5: Calculate frequency modulation and single sideband.
- 7.6: Conduct receiver troubleshooting.
- 7.7: Sketch, draw, construct, and predict results for communication circuits.

Standard 8: Integrated Circuits

- 8.1: Recognize integrated circuits.
- 8.2: Explain fabrication.
- 8.3: Sketch, draw, construct, and critique the 555 timer.
- 8.4: Estimate and measure to check outputs.
- 8.5: Discuss additional integrated circuits.
- 8.6: Model troubleshooting integrated circuits.

Standard 9: Electronic Control Devices and Circuits

- 9.1: Classify electronic control devices and circuits.
- 9.2: Identify the silicon-controlled rectifier.
- 9.3: Sketch, draw, and construct full-wave devices.
- 9.4: Calculate feedback in control devices.
- 9.5: Identify and discuss three-terminal regulators.
- 9.6: Discuss regulated power supplies.
- 9.7: Troubleshoot electronic control circuits.

Standard 10: Digital Project

- 10.1: Present constructed projects in a digital portfolio through pictures, drawings, data, and analysis.
- 10.2: Make recommendations for improvements on each project based on experiences gained from the process.

Academic Standards Integration:

- **Science:** Understanding energy forms, Newtonian physics, quantum mechanics, and relativity.
- **Mathematics:** Computation and estimation skills, problem-solving, mathematical connections.
- **ELA/Literacy:** Reading, writing, and discussion skills relevant to technical subjects.

Topics Breakdown and Weekly Schedule:

Week 1-2

- Introduction to Advanced AC and DC Circuits
- Overview of Career Opportunities in Electronics

Week 3-4

- Basic Safety Practices and Standards (OSHA, EPA, ISO, etc.)

Week 5-6

- Tools and Equipment: Identification, Usage, and Safety

Week 7-8

- History and Development of Analog Circuits

Week 9-10

- Power Supplies and Basic Amplifiers

Week 11-12

- Transistors: BJT and MOS

Week 13-14

- Types of Amplifiers and Applications

Week 15-16

- Oscillators: Characteristics and Applications

Week 17-18

- Communication Circuits: Modulation and Demodulation

Week 19-20

- Integrated Circuits: 555 Timer and Fabrication

Week 21-22

- Electronic Control Devices and Circuits

Week 23-24

- Project-Based Learning: Designing and Building Circuits

Week 25-26

- Advanced Topics in AC and DC Circuits

Week 27-28

- Final Project Work and Evaluation

Week 29-30

- Presentation and Demonstration of Final Projects

Week 31-32

- Course Review and Final Assessments

Assessment Methods:

Major Grades= 40% Minor Grades= 60% Total= 100%

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|-----------------------------------|---|-------|
| • Classwork/Homework | = | Minor |
| • Quizzes | = | Minor |
| • Exams | = | Major |
| • Papers/Presentations/Debates | = | Major |
| • Projects & Engineering Notebook | = | Major |

Late Assignments: Late work/assignments are defined as, “assignments that are submitted after the specific deadline”.

- Late assignments may result in scores being reduced by 5% per school day for a 25% maximum reduction (five school days).
- Late work submitted after the fifth school day will **NOT** be accepted.
- Repeated incidents of late work may result in a teacher-student-parent conference to examine and correct the student’s work habits through an academic contract.

Resources:

- Textbook: Electricity & Electronics 10th Edition
- Scientific journals and articles
- Online databases and tools
- Guest speakers from the energy industry

Materials:

- 5 Composition Notebooks
- Pens or Pencils
- Wired Headphones with 3.5mm jack
- 2-3” Binder (Engineering Notebook)
- Loose Leaf Paper (College Rule OK)

This syllabus provides a comprehensive overview of the Advanced AC and DC Circuits course, integrating practical skills with theoretical knowledge to prepare students for careers in electronics and related fields.

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