Illinois Mathematics and Science Academy®

igniting and nurturing creative, ethical scientific minds that advance the human condition

Comprehensive Course Syllabus
SCI435
Electronics

Course Description:
Electronics is a one-semester introductory course designed for students with an interest in hands-on experience with basic electronics. Students are encouraged to discover basic electrical concepts through laboratory-based discovery, problem-solving and laboratory analysis. Projects, incorporating the knowledge gained through guided discovery, provide a culminating experience for the students. The course will address topics in both analog and digital electronics.

Instructor:

- Mrs. Diane L. Hinterlong
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Meeting Days, Time and Room(s):
Electronics meets in E119 on AC days – Mods 16-19 and BD days – Mods 2-5

Text(s) / Materials:

References Texts:	Basic Electricity and Electronics Delton T. Horn Electric Circuits - Principles & Applications Timothy J. Maloney Electronic Devices Thomas L. Floyd
Materials:	Pencil/Pen Notebook/Paper Scientific Calculator Computer (optional but may be useful)

Student Learning Objectives:
In the process of completing Electronics, the student will:
1. Engage in the discovery of electronics principles through experimentation and discussion.
2. Demonstrate a core base of electronics knowledge and skills.
3. Engage in reflective thinking, moving through stages of thinking between the realization of a problem and the arrival at an appropriate solution.
4. Demonstrate the ability to find solutions to problems in creative and innovative ways.

5. Exhibit a willingness to engage in cooperative learning endeavors.
6. Communicate effectively through the spoken and written word.
7. Develop and engage in ethical behavior.
8. Demonstrate a joy and excitement for learning.
9. Develop and increased sense of self-confidence in the ability to deal with technologically complex problems.

The principal standards of significant learning addressed in this course are:

I. **Developing the Tools of Thought**

A. Develop automaticity in skills, concepts, and process that support and enable complex thought.
B. Construct questions which further understanding, forge connections, and deepen meaning.
C. Precisely observe phenomena and accurately record findings.
D. Evaluate the soundness and relevance of information and reasoning.

II. **Thinking About Thinking**

A. Identify unexamined cultural, historical, and personal assumptions and misconceptions that impede and skew inquiry.

III. **Extending and Integrating Thought**

A. Use appropriate technologies as extensions of the mind.
B. Recognize, pursue, and explain substantive connections within and among areas of knowledge.
C. Recreate the beautiful conceptions that give coherence to structures of thought.

IV. **Expressing and Evaluating Constructs**

A. Construct and support judgments based on evidence.
B. Write and speak with power, economy, and elegance.

V. **Thinking and Acting with Others**

B. Make reasoned decisions which reflect ethical standards, and act in accordance with those decisions.

Teaching and Learning Methodology and Philosophy:

Concepts will be introduced through experimentation supplemented by small and large group discussion. Students are expected to ask questions, make observations, collect data and analyze data. Probing questions will prompt the students to summarize their findings supported with evidence. Problem-solving will provide an opportunity to reinforce concepts. Projects provide culminating experiences to demonstrate understanding, integrate knowledge and exhibit creativity. The classroom environment is collaborative and student-centered. The entire experience will aid students in constructing their own knowledge under the facilitation of the instructor.

Student Expectations:

Students are expected to attend class on a regular basis and to be on time. Tardy and attendance issues will be dealt with in accordance with the student handbook. Unexcused tardies in excess of 10 minutes will be treated as unexcused absences.

Homework is to be handed in at the beginning of the period on the day that it is due. Late work will receive significant penalties.

Active participation in all laboratory activities is required. Non-participation will be treated the same as an absence.

Students are expected to take notes and to keep their material available for reference. Students are encouraged to seek help early if further clarity is needed on the concepts.

Violating safety rules will not be tolerated and offending students will be asked to leave the laboratory and will not receive credit for work. Collaboration between partners is encouraged. However, each partner is expected to do his/her own work.

Honesty is central to the study of science, whether in a research laboratory or at IMSA. The practices, both good and bad, that are learned in an IMSA lab will greatly influence your education and your life. Consequently, violations of ethical practice are considered a serious offense. Some examples of unethical behavior are:

- *Falsification of Data...fabrication or changing data on your labs or in your reports.*
- *Plagiarism...representing the work of someone else as your own; submitting lab reports with sections directly or indirectly quoted from another source without referencing that source.*

The "doing" of science often involves functioning as a member of a team whose task is the understanding of the phenomenon at hand. Your experience at the Academy will be no different. Practicing ethical behavior while functioning as a member of a team is essential. It is expected that data and observations from any experiment will be shared with other members of your team. It is also expected that there will be a free exchange of ideas concerning the experiment with your partners, other students, your instructors, etc. Realize however, that **the work submitted as your own**, be it in your experiment, homework or a project report, **MUST REPRESENT YOUR OWN EFFORTS**. By signing your name to it, you testify that the descriptions, calculations, results, discussions, and conclusions are yours alone, except as referenced. Copying, borrowing, lending, or sharing of the words and efforts of someone else, either directly or by paraphrasing, is plagiarism. To put this another way, **all intellectual exchanges before the writing of the report are acceptable. Unreferenced use of another person's written material or the joint production of a written report is not acceptable**, unless you are specifically instructed to write a group report.

Assessment Practices, Procedures, and Processes:

For each unit, several experiments will be conducted and supporting homework will follow the experiments. Homework will be assessed primarily on honest effort. At least one quiz will be given within each unit. Following each unit, students will engage in a project (completed individually or with a partner). Students will be provided with a self-assessment to reflect on their ownership of learning. Their reflections, with supporting

evidence, will be taken into consideration for this portion of the grade. A comprehensive final exam will be given at the end of the semester.

Laboratory Work	25%
Homework	10%
Quizzes	25%
Projects	25%
Ownership of Learning	5%
Final Exam	10%

Grading Scale: A: 93 – 100, A-: 90 – 92, B+: 87 – 89, B: 83 – 86, B-: 80 – 82, C+: 77 – 79, C: 73 – 76, C-: 70 – 72, D: Below 70

Sequence of Topics and Activities:

Introduction:

- Overview of Course
- Lab Safety
- Introduction to Lab Equipment

Unit #1:

- Ohm's Law
- Series & Parallel Circuits
- Kirchoff's Laws
- Bridge Circuits
- Project

Unit #2:

- Capacitor Overview
- Using oscilloscopes and signal generators
- Examining ac signals
- Transient Analysis of Capacitors
- Introduction to semiconductor devices
- Transistors
- Basic Digital Gates
- D Flip Flops
- JK Flip Flops
- Project

Unit #3:

- BCD-to-7 Segment Decoders
- Up/Down Counters
- Shift Registers
- Project