

APS Dual Credit STEM Electronics Course (STI)
Syllabus

Valley High School
1505 Candelaria Rd. NW
Albuquerque, NM 87107

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Course Description:

The STEM Electronics Course, Course # (ELEC 1096), is a high school level STEM Trajectory course designed for students who are interested in participating in a multi-year project to build an operational satellite (NM-RADSAT-1), build an operating ground station at Valley High School and monitor the satellite as it orbits the earth. This course is also appropriate for any students that are interested in Applied Electronics. The satellite will take 2 years to design, build and test, and will provide scientific data and experiences which will be available to all students for a minimum of five years after it is launched into orbit.

The NM-RADSAT-1 project will engage students, primarily through hands-on, applied engineering, with an emphasis on electronics, mathematics, and physics. This project is designed, using Project Based Learning concepts and strategies.

The course will introduce students to the Engineering Design Process, Project Management concepts, and the electronics theory and skill sets required to build a “Proof-of-Concept” project as the first stage of the NM-RADSAT-1 CubeSat Satellite. The lessons are also designed around the FCC requirements to earn a Technician’s Amateur Radio License.

Course Objectives:

Students will develop skills in research and analysis, teamwork, technical writing, engineering graphics and problem solving through activities, projects, and problem-based learning. All activities are designed around a team approach with on-going support from community volunteer mentors assigned to each team representing the 5 required components to replicate the minimum functions of a CubeSat:

1. Satellite Reaction Control System
2. Space Energy Generation and Storage System
3. Satellite Power Supply System
4. UHF/VHF Communications & Telemetry System
5. Satellite Camera & Imaging System

Students will develop a deep and sustainable understanding of:

1. The engineering design process
2. The connections between Electronic Theory, hands-on application and transfer of knowledge to new problems
3. Many different types of electronic testing equipment
4. Electronic circuit integration concepts

Students will be introduced to and will develop the skill-sets to be successful:

1. Creating and managing their own individual Engineering Notebook
2. Technical sketching and drawing
3. Using testing equipment to answer electronic questions related to the projects
4. Applying Ohm's Law to solve problems
5. Strategies to enhance student's success with independent study requirements
6. Computer technology manipulation (Excel, PPT, Word, etc.)
7. Team collaboration/team work and presentations as a team

Classroom Expectations:

- Students will be prepared each day and arrive to class on time each day.
- Students will complete all assigned work. All work must be turned in on time, no excuses.
- Project work is a large part of this course. Students will work together to achieve common goals.
- Students will demonstrate respect for each other and respect for each leader
- Students will be encouraged to ask questions and to be 'present' at all times
- Students will support each other and consider the other students in the course, their network of colleagues
- Students will respect the environment and restore classrooms and labs each day
- Students will follow all Valley High School Student Behavior Expectations
- Students will be held financially responsible for any intentional damage to property of VHS

Grading Policy:

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|----------------------------|-----|
| • Tardies | 10% |
| • Teamwork | 15% |
| • Homework | 10% |
| • Poster/Presentation | 15% |
| • Engineering Notebook | 25% |
| • FCC Technician's License | 25% |

Attendance Requirements:

- Absolutely no unexcused absences
- Students will be automatically dropped from the course after the 3rd excused absence
 - For the absence to be counted as “Excused” students must call or email Sergeant Newman and/or Alma Ripley before 7:30 AM and notify them of the reason.
 - Newman: (505) 917-6427 or newman_c@aps.edu
 - Ripley: (505) 410-2107 or ripley_a@aps.edu

Daily Schedule – Objectives

Week 1:

Monday, June 12	Electronics Course Overview FCC Technician’s License Requirements Leadership and Learning Styles Inventories Introduction to Basic Soldering
Tuesday, June 13	Introduction to Basic Electronics Ohm’s Law FCC Sub-elements Introduction Hands-on soldering – Electronic Kits
Wednesday, June 14	Electronic Components and Circuit Design Electronic Circuit Integration
Thursday, June 15	Satellite Systems Data Analysis/Telemetry Electronic Kits Team Presentations
Friday, June 16	Rockets/Space/Space X Introduction to Engineering Notebooks

Week 2:

Monday, June 19	Antenna Systems, Tracking Systems, APRS/GPS/CW Beacons Inductors, Magnetism and Frequencies
Tuesday, June 20	Semiconductors and Op Amps Radio Waves – Amateur Radio Frequency Bands Introduction to CubeSat Components and Proof-Of-Concept
Wednesday, June 21	Introduction to Project Management Engineering Notebook, Project Analysis, Technical drawing to clarify, KWL Charts
Thursday, June 22	FCC License Testing Requirements Proof-of-Concept Projects
Friday, June 23	Introduction to Coding ARRL Field Day Introduction and Preparation

Saturday and Sunday, June 24 and 25:

Volunteer Camping at Cochiti Lake	Participate in ARRL Field Day
<ul style="list-style-type: none"> • An annual amateur radio exercise • Emergency communications preparedness • 6:00 PM Saturday through 6:00 PM Sunday 	<ul style="list-style-type: none"> • Practice of rapid deployment of radio communications equipment in various environments • Use of emergency and alternative power sources
<ul style="list-style-type: none"> • Students experience getting “on the air” and contacting radio amateurs in Regions 1 2 and 3 • Students apply the phonetic alphabet when calling for stations 	<ul style="list-style-type: none"> • Instructors and volunteers work with small groups of students – reviewing for FCC exam, Engineering Notebooks, etc.

Week 3:

Monday, June 26	Proof-of-Concept presentation preparation FCC Practice Test
Tuesday, June 27	Proof-of-Concept presentation preparation FCC Technician’s License Exam
Wednesday, June 28	Ground and Bench testing of Proof-of-Concept artifacts Presentations – Performing Arts Center
Thursday, June 29	Field Test – HAB Launches – Mission Control Recovery Submit Engineering Notebooks for final grade
Friday, June 30	Overview of Summer 2018 Course: NM-RADSAT 1 Prototype and Ground Station Graduation and Luncheon for students and families

Standards Addressed in the Course

Common Core State Standards for English Language Arts

AS.R.4 - Reading

Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

AS.W.4 - Writing

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

AS.W.6 - Writing

Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

AS.W.10 - Writing

Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

AS.SL.1 - Speaking and Listening

Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

AS.SL.3 - Speaking and Listening

Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

AS.L.4 - Language

Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials.

AS.L.6 - Language

Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

Common Core State Standards of Mathematical Practice

1. Make sense of problems and persevere in solving them

2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with Mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

Common Core State Standards for Mathematics

N.Q.1 – Quantities

Use units as a way to understand problems to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and origin in graphs and data displays.

S.IC.2 – Making Inferences and Justifying Conclusions

Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.

Next Generation Science Standards

HS.ETS1.2 - Engineering Design

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS.ETS1.3 – Engineering Design

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.