

WRHS Science Curriculum Syllabus

Course Name: Engineering Physics

Grade Level: 11 & 12

Course Description:

This course will meet as a combined AF-AE class. Students will learn and apply the basic principles of physics, with an emphasis on mechanics and material science, and the basics of engineering design in an integrated problem-solving environment. These devices might be potential solutions to a specific problem utilizing physics knowledge gained in the course. Many of the topics will include the design, fabrication and testing of a device that demonstrates the principles being presented. There might also be a variety of guest speakers from the engineering field. They will discuss various opportunities in engineering and provide real life examples of using engineering to solve problems. Included could be WPI students who would present the MQP projects and discuss the development of the idea and the work that goes into the solution.

Links to Student Expectations:

- All students will develop skills to utilize technology to gather, to evaluate, to assimilate, and to present information.
- All students will utilize critical thinking skills to identify and to provide resources to solve a problem.
- All students will be able to make decisions and solve problems using logical processes (e.g., scientific method, induction, deduction, syllogism, etc.).
- All students will develop skills to promote a sense of confidence in tackling the rigors of standardized tests such as the required MCAS and optional AP, SAT.

Interdisciplinary Connections:

The concepts of physics integrated with engineering practices and procedures extends well beyond those areas alone. Projects may require and apply knowledge in many different and diverse fields, including (but not limited to): computer skills, chemistry, biology and other life sciences, mathematics, English, communication and presentation skills, history of theory and product, including important inventions, basic research, marketing, manufacturing and advertising, graphic arts, cost breakdown and analysis, product or patent law, ethics.

I. Essential Questions for Course

- What is physics, and how is it related to all sciences?
- What is engineering, and how does it relate specifically to the science of physics?

- How is the job of a physicist different from that of an engineer or technician in background, training, employer, and salary?
- Do all engineers have a basic method or technique in their job?
- How has technology developed and evolved over the past five hundred years?
- How can processes and technological applications be refined or modified to improve efficiency?
- What moral, legal and/or ethical questions may engineers face in order to assure continued promotion and use of new technologies?
- How can scientists and engineers improve the quality of life?

II. Student Objectives

- To learn and understand some of the major concepts of physics, in order to be able to identify the underlying principle(s) in technology-based products.
- To learn how to communicate effectively: as an individual, in a group, on paper, on a computer, mathematically, orally, persuasively.
- To understand, and be an active participant in group dynamics, brainstorming, modification and reinforcement of ideas, cooperative planning and assessment.
- To know what it means to be in a leadership role, and the responsibilities that must be defined and applied as such.
- To understand the role of the scientist and the engineer in improving the quality of life.
- To be able to think critically toward the identification and solution of problems, be they scientific, technological, or societal.

III. Suggestions for Instruction

- Lectures (including A/V devices for enhanced presentation)
- Discussions (class, small group, etc.)
- Handouts
- Simple individual or small-group introductory projects
- Detailed major long-term group projects
- Teacher conducted demonstrations
- Videos (instructional, documentary, etc.)
- Movies (science/engineering themes)
- Internet sites
- Community outreach (professional scientists, engineers, post-secondary students, business and industry leaders, etc.)

IV. Suggestion for Assessment

- Written assignments with a variety of question types
- Individual or small group project assessment, based on pre-defined expectations, and/or in competitive-based performance

- Depth of understanding of project concepts and involvement based on individual reaction paper
- Performance on team-based tests
- Evaluation by student designated group leader
- Oral and poster presentations on both individual and group level

V. Curriculum

- Engineering topic introduction and areas of application.
- Physics topics relevant to current project. Topics such as mechanics, thermodynamics, properties of matter, electromagnetism, and wave theory.
- Scale prototype project.

VI. Lesson Extensions

- Extend the calculations, data collection and analysis for various physics and engineering-based projects and instructions.
- Extend the theory and mathematical techniques utilized in problem solving in the specific area of physics
- Produce and present an individual experimental research engineering/physics-based project, starting in September and entered in February Science Fair.