

CARLSTADT-EAST RUTHERFORD REGIONAL HIGH SCHOOL DISTRICT
SCIENCE DEPARTMENT
PHYSICS OF ENGINEERING

Physics of Engineering Curriculum Guide

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| <p>Pacing Guide</p> <p>Physics of Engineering is a full year course that meets on a rotating basis for three (3) 55-minute blocks and one (1) 40-minute block for every five (5) day cycle.</p> | <p>Chapter 1: What is Engineering?, 2 weeks</p> <p>Chapter 2: Engineering Design, 2 weeks</p> <p>Chapter 3: Defining Problems and Brainstorming, 2 weeks</p> <p>Chapter 4: Researching Designs, 2 weeks</p> <p>Chapter 5: Communicating Solutions, 2 weeks</p> <p>Chapter 6: Modeling, Testing, and Final Outputs, 2 weeks</p> <p>Chapter 7: Materials Engineering, 2-3 weeks</p> <p>Chapter 8: Electrical Engineering</p> <p>Chapter 9: Civil Engineering, 2 weeks</p> <p>Chapter 10: Mechanical Engineering, 3 weeks</p> <p>Chapter 11: Bioengineering, 2 weeks</p> <p>Chapter 12: Computer Engineering, 2 weeks</p> <p>Chapter 13: Aerospace Engineering, 2 weeks</p> <p>Chapter 14: Manufacturing Engineering, 2 weeks</p> <p>Chapter 15: Chemical Engineering, 2 weeks</p> <p>Chapter 16: Engineering as a Profession, 2 weeks</p> |
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| <p>21st Century Skills Standards:</p> <p>9.1 Personal Finance Literacy</p> <p>9.2 Career Awareness</p> | <p>9.1.12.A.3: Analyze the relationship between various careers and personal earning goals.</p> <p>9.1.12.A.4: Identify a career goal and develop a plan and timetable for achieving it, including educational/training requirements, costs, and possible debt</p> <p>9.1.12.B.1: Prioritize financial decisions by systematically considering alternatives and possible consequences.</p> <p>9.1.12.C.4: Determine the relationships among income, expenses, and interest.</p> <p>9.1.12.E.4: Evaluate how media, bias, purpose, and validity affect the prioritization of consumer decisions and spending.</p> <p>9.1.12.E.5: Evaluate business practices and their impact on individuals, families, and societies.</p> <p>9.1.12.F.2: Assess the impact of emerging global economic events on financial planning.</p> <p>9.2.12.C.1: Review career goals and determine steps necessary for attainment.</p> <p>9.2.12.C.5: Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures.</p> |
| <p>Technology Standards</p> | <p>8.1.12.A.2: Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.</p> <p>8.1.12.A.4: Construct a spreadsheet, enter data, and use mathematical or logical functions to manipulate data, generate charts and graphs, and interpret the results.</p> |

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| <p>Interdisciplinary Connections</p> | <p>Sciences: Forming hypothesis, states of matter, scientific observations and experiments, the periodic table, magnetism, chemical compounds, mass, weigh, and gravity.</p> <p>Math: Converting fractions to decimals, triangles, Pythagorean theorem, calculations with circles, scientific notation, trigonometric functions, matrices, ratios and scale.</p> <p>History: Engineering design in history, history of drafting, history of reverse engineering, history of batteries, history of biological engineering, electrical engineering in history, municipal water system engineering, computer engineering in history, aerospace engineering in history.</p> |
| <p>NJSLS Career Ready Practices – These practices are demonstrated throughout the curriculum</p> | <p>CRP1. Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason. CRP5. Consider the environmental, social and economic impacts of decisions. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management. CRP10. Plan education and career paths aligned to personal goals. CRP11. Use technology to enhance productivity. CRP12. Work productively in teams while using cultural global competence.</p> |

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Differentiation/Accommodations/Modifications

| Gifted and Talented | English Language Learners | Students with Disabilities | Students at Risk of School Failure |
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| <p><i>(content, process, product and learning environment)</i></p> <p>Extension Activities:</p> <ul style="list-style-type: none"> • Conduct research and provide presentation of mathematical topics. • Design surveys to generate and analyze data to be used in discussion. • Use of higher level questioning techniques. • Provide assessments at a higher level of thinking. | <p>Modifications for Classroom:</p> <p>Modifications for Homework/Assignments</p> <ul style="list-style-type: none"> • Modified assignments. • Extended time for assignment completion as needed. • Use graphing calculator. • Highlight formulas. | <p><i>(appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team)</i></p> <p>Modifications for Classroom:</p> <ul style="list-style-type: none"> • Ask students to restate information, directions, and assignments. • Repetition and practice. • Model skills / techniques to be mastered. • Extended time to complete class work. • Provide copy of class notes. • Preferential seating to be mutually determined by the student and teacher. • Students may request books online, on tape/CD, as available and appropriate. • Assign peer helper in the class setting. • Provide regular parent / school communication • Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments <p>Modifications for Homework</p> | <p>Modifications for Classroom:</p> <ul style="list-style-type: none"> • Ask students to restate information, directions, and assignments. • Repetition and practice. • Model skills / techniques to be mastered. • Extended time to complete class work. • Provide copy of class notes. • Preferential seating to be mutually determined by the student and teacher. • Students may request books online, on tape/CD, as available and appropriate. • Assign peer helper in the class setting. • Provide oral reminders and check student work during independent work time. • Assist student with long and short term planning of assignments • Provide regular parent / school communication. • Assign peer helper in the class setting. • Provide oral reminders and check student work during independent work time. |

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| | | <ul style="list-style-type: none"> • Extended time to complete assignments. • Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases. • Provide the student with clearly stated (written) expectations and grading criteria for assignments. <p>Modification for Assessments</p> <ul style="list-style-type: none"> • Extended time on classroom tests and quizzes. • Student may take / complete tests in an alternate setting as needed. • Restate, reread, and clarify directions/questions. • Distribute study guide for classroom tests. <ul style="list-style-type: none"> • Establish procedures for accommodations / modifications for assessments. | <ul style="list-style-type: none"> • Assist student with long and short term planning of assignments <p>Modifications for Homework</p> <ul style="list-style-type: none"> • Extended time to complete assignments. • Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases. • Provide the student with clearly stated (written) expectations and grading criteria for assignments. <p>Modification for Assessments</p> <ul style="list-style-type: none"> • Extended time on classroom tests and quizzes. • Student may take / complete tests in an alternate setting as needed. • Restate, reread, and clarify directions/questions. • Distribute study guide for classroom tests. <ul style="list-style-type: none"> • Establish procedures for accommodations / modifications for assessments. |
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| CONTENT: Chapter 1 | | | |
| Theme: What is Engineering? | | | |
| Essential Questions: What is engineering? What is the role of engineers? What are the different disciplines of engineering? What is the history of engineering? How is Engineering related to the study of Physics? | | | |
| <p>Content (<i>As a result of this learning segment, students will know...</i>)</p> <ul style="list-style-type: none"> • What is engineering and the role of engineers • Types of knowledge • Different disciplines of engineering • History of engineering • How is Engineering related to the study of Physics? | <p>Skills (<i>As a result of this learning segment, students will be able to...</i>)</p> <ul style="list-style-type: none"> • Students will be able to define engineering. • Identify and describe the types of knowledge used by engineers. • List the roles that make an engineering team. • List several engineering disciplines. • Summarize the historical developments in engineering. • Connect Physics to Engineering | <p>Assessments (The above Essential Questions will be assessed with the following formative and summative measures:)</p> <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Labs • Midterm exam • Final Exam | <p>Standards: HS-ETS1-1 A,B, and C HS-ETS1-2 HS-ETS1-3 HS-ETS1-4</p> |
| | | | <p>Time Frame: 2 weeks</p> |
| | | | <p>Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher ISBN: 978-1-61960-220-5</p> <p><i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher ISBN: 978-0-07845813-7</p> <p>Workbook Activity 1-1, 1-2, and 1-3 Workbook ISBN: 978-1-61960-227-4</p> <p>Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation.</p> |

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| CONTENT: Chapter 2 | | | | | |
| Theme: Engineering Design | | | | | |
| Essential Questions: What are the steps of the engineering design process? How to define a problem and its constraints? How to create and test design solutions? | | | | | |
| <p>Content (<i>As a result of this learning segment, students will know...</i>)</p> <ul style="list-style-type: none"> • Engineering design process • Define problems and its constraints • Create and test design solutions | <p>Skills (<i>As a result of this learning segment, students will be able to...</i>)</p> <ul style="list-style-type: none"> • Students will be able to define engineering designs • Describe the steps of the engineering design process • Explain how to define a problem and its constraints • Identify various methods and ideation • Summarize the processes of creating and testing design solutions • Explain how to communicate the final design solution • Describe the purpose of an engineering notebook | <p>Assessments (The above Essential Questions will be assessed with the following formative and summative measures:)</p> <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Labs • Midterm exam • Final Exam | <p>Standards: HS-ETS1-1 A,B, and C HS-ETS1-2 HS-ETS1-3 HS-ETS1-4</p> | | |
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| CONTENT: Chapter 3 | | | |
| Theme: Defining Problems and Brainstorming | | | |
| Essential Questions: What are the steps needed to identify problems? How constraints and criteria are involved in engineering design process? | | What is brainstorming? How can the Scientific Method help in Problem Finding and Problem Solving? How do Physicists and Engineers work together using the Scientific Method? | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Defining problems • Generating criteria and constraints • Brainstorming techniques Brainstorming in history • How can the Scientific Method help in Problem Finding and Problem Solving? • How do Physicists and Engineers work together using the Scientific Method? | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Identify steps used to define problems • Describe how constraints and criteria are involved in the engineering design process • Explain the goals of brainstorming • Identify different brainstorming techniques • Explain the importance of problem definition and idea generation to the engineering design process • Apply math and physics formula to solve engineering problems. | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Labs • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B, and C HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 |
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| CONTENT: Chapter 4 | | | | |
| Theme: Researching Designs | | | | |
| Essential Questions: What are the different types of library research? How to communicate potential solution ideas using sketches? How to select the optimal solution? How can Physical Science and Physics Research Designs assist Engineers today? | | | | |
| <p>Content (<i>As a result of this learning segment, students will know...</i>)</p> <ul style="list-style-type: none"> • Library research • Experimental research • Using sketches • Select optimal solution • How can Physical Science and Physics Research Designs assist Engineers today? | <p>Skills (<i>As a result of this learning segment, students will be able to...</i>)</p> <ul style="list-style-type: none"> • Explain how to communicate potential solution ideas using sketches • Describe different types of library research • Identify properties found through experimental research • Analyze trade-offs in engineering design • Explain how to select the optimal solution | <p>Assessments (The above Essential Questions will be assessed with the following formative and summative measures:)</p> <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Labs • Midterm exam • Final Exam | <p>Standards: HS-ETS1-1 A,B, and C HS-ETS1-2 HS-ETS1-3 HS-ETS1-4</p> | |
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| CONTENT: Chapter 5 | | | |
| Theme: Communicating solutions | | | |
| Essential Questions: How to communicate design solution properly? What are the different types of drawings? | | | |
| <p>Content <i>(As a result of this learning segment, students will know...)</i></p> <ul style="list-style-type: none"> • Engineering drawings • Working drawings • Drawing classifications • Pictorial drawings • Drawing guidelines • Industry guidelines | <p>Skills <i>(As a result of this learning segment, students will be able to...)</i></p> <ul style="list-style-type: none"> • Explain the importance of properly communicating design solutions • Identify three types of working drawings • Describe different drawing classifications • Elect and use appropriate symbols • Identify line types used in drawings • Describe dimensioning guidelines • Discuss industry guidelines used in communicating design solutions | <p>Assessments (The above Essential Questions will be assessed with the following formative and summative measures:)</p> <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Labs • Midterm exam • Final Exam | <p>Standards: HS-ETS1-1 A,B, and C HS-ETS1-2 HS-ETS1-3 HS-ETS1-4</p> <p>Time Frame: 2 weeks</p> <p>Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher <i>ISBN: 978-1-61960-220-5</i></p> <p><i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher <i>ISBN: 978-0-07845813-7</i></p> <p>Workbook Activity 1-1, 1-2, and 1-3 Workbook <i>ISBN: 978-1-61960-227-4</i></p> <p>Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation.</p> |

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| CONTENT: Chapter 6 | | | | | | |
| Theme: Modeling, Testing, and Final Outputs | | | | | | |
| Essential Questions: What are the different types of modeling? What are the steps needed for testing? What are the different types of final outputs? | | | | | | |
| <p>Content (<i>As a result of this learning segment, students will know...</i>)</p> <ul style="list-style-type: none"> • Mathematical modeling • Physical modeling • Computer modeling • Predictive analysis • Testing • Engineering economics • Final outputs | <p>Skills (<i>As a result of this learning segment, students will be able to...</i>)</p> <ul style="list-style-type: none"> • Explain the importance of predictive analysis to the engineering design process • Describe principles used in mathematical modeling • Identify different types of physical modeling • Discuss how computer modeling is used in different engineering fields • Explain the testing process • Describe different types of final outputs | <p>Assessments (The above Essential Questions will be assessed with the following formative and summative measures:)</p> <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Labs • Midterm exam • Final Exam | <p>Standards: HS-ETS1-1 A,B, and C HS-ETS1-2 HS-ETS1-3 HS-ETS1-4</p> | | | |
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| CONTENT: Chapter 7 | | | | |
| Theme: Materials Engineering | | | | |
| Essential Questions: What is material engineering? What are the different types of materials? What is nanotechnology? | | What are Newton's Law's of Motion? How can Newton's Laws help in the design of Materials? Understand how momentum and energy conservation aid in the production of Nanotechnology How has Nanotechnology revolutionized the way we live? | | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Principles of material engineering • Material types • Material properties • Material engineering applications • Nanotechnology • Material engineering in action • What are Newton's Law's of Motion? • How can Newton's Laws help in the design of Materials? • Understand how momentum and energy conservation aid in the production of Nanotechnology • How has Nanotechnology revolutionized the way we live? | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define material engineering • Identify different types of materials • Describe a range of material properties • List examples of material tests • Describe nanotechnology • Apply Newton's Law to engineering designs • Understand the role of momentum and energy conservation in the production of Nanotechnology | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B, and C HS-ETS1-2, HS-ETS1-3 HS-ETS1-4 HS-PS2-1, HS-PS2-2 HS-PS2-3, HS-PS2-4 | |
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| CONTENT: Chapter 8 | | | | |
| Theme: Electrical Engineering | | | | |
| Essential Questions: What is electrical engineering? How electrons move on an atomic level? What are the sources of electricity? | | What are the requirements for employment in the electrical engineering profession? What is the connection between Statics Electricity and Electric Fields? Understand Currents, Series and Parallel Circuits and Electromagnetic Induction as it relates to Electrical Engineering? | | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Electrical engineering principles • Electricity on the atomic level • Static electricity • Source of electricity • Laws • Basic circuits • Components platforms • Electrical engineering in action • What is the connection between Statics Electricity and Electric Fields? • Understand Currents, Series and Parallel Circuits and Electromagnetic Induction as it relates to Electrical Engineering? | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define electrical engineering • Explain how electrons move on an atomic level • Describe the characteristics of voltage, current, resistance, and power • Explain Ohm’s law and use it to solve for values in a circuit • Identify the operation and application of common electronic components such as resistors, switches, capacitors, diodes, and transistor • Understand the connection between Static Electricity and Electric fields • Distinguish the difference between series and parallel electric circuits in Electrical Engineering. | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B, and C HS-ETS1-2, HS-ETS1-3 HS-ETS1-4 HS-PS2-5, HS-PS4-4 | |
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| CONTENT: Chapter 9 | | | | |
| Theme: Civil Engineering | | | | |
| Essential Questions: What is civil engineering? What are the different types of structural materials? What is structural component, force and load? | | What are the requirements for employment in the civil engineering profession? Understand Forces and Motions in One and Two Dimensions and their relation to civil engineers. How can Civil Engineers use Physics Concepts to build bigger bridges and taller building? | | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Civil engineering principles • Structural materials • Civil engineering applications • Skyscraper • Civil engineering in action • Understand Forces and Motions in One and Two Dimensions and their relation to civil engineers. • How can Civil Engineers use Physics Concepts to build bigger bridges and taller building? | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define civil engineering • Describe structural forces, loads, and components • Identify different types of bridges • Understand the structure of a skyscraper • Describe the purpose of land surveying • Understand the connection between Physics and massive construction such as bridges and sky scrapers. | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B,C, HS-ETS1-2 HS-ETS1-3, HS-ETS1-4 HS-PS2-2, HS-PS2-3 | |
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| CONTENT: Chapter 10 | | | | |
| Theme: Mechanical Engineering | | | | |
| Essential Questions: What is mechanical engineering? What are the requirements for employment in the mechanical engineering profession? | | What is the connection between Statics Electricity and Electric Fields? Understand Currents, Series and Parallel Circuits and Electromagnetic Induction as it relates to Electrical Engineering? What is mechanical power? | | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Principles of mechanical engineering • Mechanical energy and motion • Mechanical power systems • Power sources, transmission and control devices • Mechanical power principles and formulas • Mechanical engineering applications • Mechanical engineering in action • What is the connection between Statics Electricity and Electric Fields? • Understand Currents, Series and Parallel Circuits and Electromagnetic Induction as it relates to Electrical Engineering? | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define mechanical engineering • Explain the concepts of energy, motion, and simple machines • Summarize the components of mechanical and fluid power system • Describe principles of mechanical power • Give examples of mechanical engineering applications • Understand the connection between Static Electricity and Electric fields • Distinguish the difference between series and parallel electric circuits in Electrical Engineering. | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B, C, HS-ETS1-2 HS-ETS1-3, HS-ETS1-4 HS-PS2-2, HS-PS2-5 HS-PS4-4 | |
| | | | Time Frame: 2 weeks | |
| | | | Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher ISBN: 978-1-61960-220-5 <i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher ISBN: 978-0-07845813-7 Workbook Activity 1-1, 1-2, and 1-3 Workbook ISBN: 978-1-61960-227-4 Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation. | |

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| CONTENT: Chapter 11 | | | | |
| Theme: Bioengineering | | | | |
| Essential Questions: What is bioengineering? What is agriculture engineering? What is biomedical and biological engineering? | | What are the requirements for employment in the bioengineering profession? Sound, Light, Reflection & Refraction, and Interference and Diffraction How can the study of physics principles assist in curing modern day diseases? | | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Principles of bioengineering • Genetics • Homeostasis • Thermochemical conversion • Biological engineering • Agricultural engineering • Biomedical engineering • Biological engineering in action • Sound, Light, Reflection & Refraction, and Interference and Diffraction • How can the study of physics principles assist in curing modern day diseases? | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define bioengineering • Identify the five fields of study on which all bioengineering is based • Discuss the different forms of bioconversion used in biological engineering • Describe the role of bioengineering in agricultural production • Describe the impact of biomedical engineering on our society • Understand the role of sound, light, reflection & refraction in Bioengineering. | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B, C, HS-ETS1-2 HS-ETS1-3, HS-ETS1-4 HS-LS3-1,2 HS-PS4-1, HS-PS4-5 | |
| | | | Time Frame: 2 weeks | |
| | | | Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher ISBN: 978-1-61960-220-5 <i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher ISBN: 978-0-07845813-7 Workbook Activity 1-1, 1-2, and 1-3 Workbook ISBN: 978-1-61960-227-4 Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation. | |

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| CONTENT: Chapter 12 | | | | |
| Theme: Computer Engineering | | | | |
| Essential Questions: What is computer engineering? How are logic and algorithms used in computer engineering? How is database used in computer engineering? | | What are the requirements for employment in the computer engineering profession? How has computer science changed the way we experiment complex Physics topics and principles? What is the relationship between algorithms and physics? | | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Principles of computer engineering • Logic and algorithms • Computer architecture • Digital signal processing • Software engineering • Computer engineering applications • Robotics • Computer engineering in action • How has computer science changed the way we experiment complex Physics topics and principles? • What is the relationship between algorithms and physics? | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define computer engineering • Explain the operation of logic gates • Understand the purpose of databases • Describe the uses of algorithms • Describe the function of basic parts of a personal computer • Understand binary code • Give examples of computer engineering applications • Understand the relation between computer programming algorithms and physics. | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B, C, HS-ETS1-2 HS-ETS1-3, HS-ETS1-4 | |
| | | | Time Frame: 2 weeks | |
| | | | Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher <i>ISBN: 978-1-61960-220-5</i> <i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher <i>ISBN: 978-0-07845813-7</i> Workbook Activity 1-1, 1-2, and 1-3 Workbook <i>ISBN: 978-1-61960-227-4</i> Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation. | |

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| CONTENT: Chapter 13 | | | |
| Theme: Aerospace Engineering | | | |
| Essential Questions: What is Aerospace engineering? How are logic and algorithms used in computer engineering? How is Newton’s law in motion used in aerospace engineering? | | What are the requirements for employment in the aerospace engineering profession? How can Aerospace Engineers help Astrophysicists in better understanding the universe? What is Thermonuclear Fusion? | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Principles of aerospace engineering • Newton’s law • Fluid mechanics • Laws of conservation • Principles of flight • Aerospace engineering applications • Aerospace engineering in action • How can Aerospace Engineers help Astrophysicists in better understanding the universe? • What is Thermonuclear Fusion? | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define aerospace engineering • Explain Newton’s law in motion • Explain the roles of fluid mechanics and aerodynamics in aerospace engineering • Understand the laws of conservation • Describe the forces acting on an aircraft in flight • Give examples of aerospace engineering applications • Understand the connection between Astrophysicists and Aerospace engineering in understanding the universe. | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B,C, HS-ETS1-2 HS-ETS1-3, HS-ETS1-4 HS-PS2-1 |
| | | | Time Frame: 2 weeks |
| | | | Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher ISBN: 978-1-61960-220-5 <i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher ISBN: 978-0-07845813-7 Workbook Activity 1-1, 1-2, and 1-3 Workbook ISBN: 978-1-61960-227-4 Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation. |

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| CONTENT: Chapter 14 | | | |
| Theme: Manufacturing Engineering | | | |
| Essential Questions: What is manufacturing engineering? What are the different materials used in manufacturing engineering? | | How raw materials are harvested? What are the requirements for employment in the manufacturing engineering profession? Review the relationship between Manufacturing Engineering and Solid State Electronics. | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Principles of manufacturing engineering • Manufacturing materials • Manufacturing engineering processes • Production management • Production control • Manufacturing engineering applications • Manufacturing engineering in action • Review the relationship between Manufacturing Engineering and Solid State Electronics. | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define manufacturing engineering • Explain how raw materials are harvested • Describe the manufacturing processes • Discuss applications of production management • List and describe the main areas of production control • Give examples of manufacturing engineering applications | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B,C, HS-ETS1-2 HS-ETS1-3, HS-ETS1-4 |
| | | | Time Frame: 2 weeks |
| | | | Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher ISBN: 978-1-61960-220-5 <i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher ISBN: 978-0-07845813-7 Workbook Activity 1-1, 1-2, and 1-3 Workbook ISBN: 978-1-61960-227-4 Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation. |

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| CONTENT: Chapter 15 | | | | |
| Theme: Chemical Engineering | | | | |
| Essential Questions: What is chemical engineering? What are the laws of thermodynamics and how they are used in chemical engineering? How mass balance is used to analyze chemical processes? What is fluid dynamics and its effect on chemical engineering? | | What are the requirements for employment in the chemical engineering profession? Understand the Bohr and Quantum Model of the Atom. Why should Chemical Engineers understand the size of an Atom? Discuss Nuclear Decay and Reactions and its relation to Chemical Engineers. | | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Principles of chemical engineering • Chemistry and Thermodynamics • Mass balance • Fluid dynamics • Measurements • Chemical engineering applications • Chemical engineering in action • Understand the Bohr and Quantum Model of the Atom. • Why should Chemical Engineers understand the size of an Atom? • Discuss Nuclear Decay and Reactions and its relation to Chemical Engineers. | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • Define chemical engineering • Compare and contrast chemistry and chemical engineering • Explain the laws of thermodynamics and how they are used in chemical engineering • Explain how mass balance is used to analyze chemical processes • Describe fluid dynamics and its effect on chemical engineering • Discuss different types of measurement used in chemical engineering • List and explain the factors a chemical engineer might consider when designing a chemical plant and choosing a site • Describe OSHA and its goal to keep workers and community members safe from exposure to hazardous chemicals • Give examples of chemical engineering applications • Understand the importance of Atom size in Chemical Engineering. | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B,C, HS-ETS1-2 HS-ETS1-3, HS-ETS1-4 HS-PS1-1,2,3,7 HS-PS1-3, HS-PS1-7 | |
| | | | Time Frame: 2 weeks | |
| | | | Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher ISBN: 978-1-61960-220-5 <i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher ISBN: 978-0-07845813-7 Workbook Activity 1-1, 1-2, and 1-3 Workbook ISBN: 978-1-61960-227-4 Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation. | |

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| CONTENT: Chapter 16 | | | |
| Theme: Engineering as a Profession | | | |
| Essential Questions: What are the functions of engineers? What are the professional aspects of engineering? | | How are the types of impacts of engineering? What is the future of engineering? | |
| Content (<i>As a result of this learning segment, students will know...</i>) <ul style="list-style-type: none"> • Functions of engineers • Teamwork • Engineering profession • Engineering impacts • Future of engineering | Skills (<i>As a result of this learning segment, students will be able to...</i>) <ul style="list-style-type: none"> • List and define the various functions of engineers • Describe the professional aspects of engineering • Describe the purpose of codes of ethics • Provide examples of the types of impacts of engineering • Describe the future of engineering | Assessments (The above Essential Questions will be assessed with the following formative and summative measures:) <ul style="list-style-type: none"> • Homework • Warm up exercises • Exit Tickets • Group activities • Section quizzes • Chapter tests • Cumulative tests • Projects / Presentations • Midterm exam • Final Exam | Standards: HS-ETS1-1 A,B,C, HS-ETS1-2 HS-ETS1-3, HS-ETS1-4 9.1.12.A.3, 9.1.12.A.4 9.2.12.C.1 |
| | | | Time Frame: 1-2 weeks |
| | | | Materials: Textbooks: <i>2014 Ryan A. Brown, Engineering Fundamentals Design, Principles, and Careers</i> by G-W Publisher ISBN: 978-1-61960-220-5 <i>2005 Zitzewitz, Physics, Principles and Problems</i> by Glenco Publisher ISBN: 978-0-07845813-7 Workbook Activity 1-1, 1-2, and 1-3 Workbook ISBN: 978-1-61960-227-4 Smart board, internet research and activities, video streaming podcasting, AutoCAD, and multimedia presentation. |