

Engineering Concepts					
Course Description					
<p><i>Engineering Concepts (EC) is a high school-level survey course of engineering. The course exposes students to some of the major concepts that they will encounter in a postsecondary engineering course of study. Students have an opportunity to investigate engineering and high tech career opportunities which gives students the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APPB) learning. Used in combination with a teaming approach, APPB learning challenges students to continually hone their interpersonal skills, creative abilities, and problem solving skills based upon engineering concepts. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.</i></p>					
Program of Study to which the course applies	Course Code				
STEM-	103192				
	Course Content	Reference Standards	Academic Crosswalk to Common Core Standards	Academic Crosswalk to Nebraska Standards	Comments
Standard 1	Students will research engineering areas of interest.	CCC			
Benchmark 1.1	Investigate mathematical, science and technology requirements for success in the chosen area of engineering.	NCE 2	ELA.WHST.11-12.7-9	LA.12.1.6.j LA.12.4.1.a-c SC.12.1.3.h	The depth of students' investigations, and thus the research standards that apply, will be determined by the nature of the task (CC: ELA.WHST.11-12.7-9; NE: LA.12.1.6.j, LA.12.4.1.a-c).
Sample Performance Indicator 1.1.1	Research formulated engineering problems, case studies.				
Sample Performance Indicator 1.1.2	Interview an engineer.				
Benchmark 1.2	Research possible career opportunities in the content area.		ELA.WHST.11-12.7-9	LA.12.1.6.j LA.12.4.1.a-c	The depth of students' investigations, and thus the research standards that apply, will be determined by the nature of the task (CC: ELA.WHST.11-12.7-9; NE: LA.12.1.6.j, LA.12.4.1.a-c).

Sample Performance Indicator 1.2.1	Research: what their day looks like, what professional responsibilities do they have and how much money do they make.				
Benchmark 1.3	Communicate research results in oral and written forms.		ELA.SL.11–12.4-6 ELA.WHST.11–12.8	LA.12.2.2 LA.12.3.1 LA.12.4.1.a	
Sample Performance Indicator 1.3.1	Create a presentation using online visual tool (e.g. PowerPoint presentation, Prezi, Youtube, animation).				
Sample Performance Indicator 1.3.2	Write a want ad for new employee in area of engineering.				
Standard 2	Students will properly apply safe procedures, practices, and equipment operation.	OSHA			
Benchmark 2.1	Practice required safety standards according to industry.	OSHA	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2)
Sample Performance Indicator 2.1.1	Successfully complete written safety assessment.				
Sample Performance Indicator 2.1.2	Sign and abide by safety contract.				
Standard 3	Students will demonstrate design process principles.	IED 1			

Benchmark 3.1	Use the design process to define a problem and research a solution.	IED 1	ELA.RST.11-12.3 MTH.G.MG.3	LA.12.1.6.k LA.12.3.2 MA.12.2.4.a SC.12.1.3.a SC.12.1.3.b	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2). Alignment presumes that students will sketch design solutions using geometric objects while defining a problem and researching a solution
Sample Performance Indicator 3.1.1	Apply Engineering notebook standards and protocols during documentation.				
Sample Performance Indicator 3.1.2	Gather information using various sites and resources.				
Sample Performance Indicator 3.1.3	Sketch possible solutions to problem stated.				
Sample Performance Indicator 3.1.4	Use of oblique and isometric sketching techniques to represent solution.				
Benchmark 3.2	Engage in design teams to brainstorm possible solutions.	IED 4.2, NCS D4	ELA.SL.11–12.1	LA.12.3.3 SC.12.1.3.a	
Sample Performance Indicator 3.2.1	Sketch possible solutions to problem stated.				
Sample Performance Indicator 3.2.2	Develop a set of team norms or guidelines to follow.				
Benchmark 3.3	Apply basic technical sketching and drawing skills.	NCS D4	ELA.WHST.11-12.6 MTH.G.MG.3	MA.12.2.4.a MA.12.2.4.b MA.12.2.5.b	Alignment presumes that students will sketch geometric objects and apply appropriate units and scales for measurement (CC: MTH.G.MG.3; NE: MA.12.2.4.a,b, MA.12.2.5.b)
Sample Performance Indicator 3.3.1	Use of oblique, isometric and multiview sketching techniques to represent the solution.				

Sample Performance Indicator 3.3.2	Use measurement and statistics.				
Sample Performance Indicator 3.3.3	Use universal standardized symbolic languages to communicate, such as, mathematical equations, drafting standards, American Society of Heating, Refrigerating, and Air-condition Engineers, Inc. (ASHRAE) Handbook, American National Standards Institute (ANSI) Standards, and related professional codes.				
Sample Performance Indicator 3.3.4	Understand engineered outcomes must be documented to accepted standards with precision in order to aid in avoiding unnecessary harm.				
Standard 4	Student will demonstrate advanced 3D modeling software skills.	IED			
Benchmark 4.1	Demonstrate proficiency in using terminology, symbols, codes and standards in 3D drawings.		ELA.WHST.11-12.6 ELA.L.11-12.6	LA.12.1.6.f LA.12.1.5	
Sample Performance Indicator 4.1.1	Identify ANISI symbols for CAD drawing.				
Sample Performance Indicator 4.1.2	Research National Institute for Standards for measurement standards and International Standards Organization for international standards.				

Benchmark 4.2	Demonstrate mastery level using geometric and numeric constraints to define the shape and size of objects in Computer Aided Design (CAD) modeling systems.	IED 1.4	MTH.G.MG.3	MA.12.2.4.a MA.12.2.4.b	
Sample Performance Indicator 4.2.1	Create complex extruded solid Computer Aided Design (CAD) models from dimensioned sketches.				
Sample Performance Indicator 4.2.2	Apply geometric and numeric constraints to CAD sketches.				
Benchmark 4.3	Design and construct a complex 3-dimensional object.	IED 1.4	MTH.G.MG.1 MTH.G.MG.3	MA.12.2.4.a SC.12.1.3.a	
Sample Performance Indicator 4.3.1	Select an approach that meets or satisfies the constraints given in a design brief.				
Sample Performance Indicator 4.3.2	Create complex extruded solid Computer Aided Design (CAD) models from real world object.				
Standard 5	Students will produce a product/project for evaluation.	NCS 1, NCS 3			
Benchmark 5.1	Logically segment problems and opportunities from an engineering perspective to derive effective solutions (use Engineering Design Process).	NCS 3		SC.12.1.3.a SC.12.1.3.b SC.12.1.3.c SC.12.1.3.d SC.12.1.3.e	Alignment presumes that students will propose technical designs, assess the limits of the design, implement a solution, evaluate the solution, and communicate the process to derive effective solutions (NE: SC.12.1.3.a, SC.12.1.3.b, SC.12.1.3.c, SC.12.1.3.d, SC.12.1.3.e).

Sample Performance Indicator 5.1.1	Use engineering notebook documentation or worksheet to log the Engineering Design Process (1. Define the problem. 2. Research the problem. 3. Create possible solutions. 4. Choose the best solution. 5. Create a prototype. 6. Test and evaluate. 7. Communicate. 8. Redesign.)				
Sample Performance Indicator 5.1.2	Brainstorm and discuss the product process.				
Sample Performance Indicator 5.1.3	Create a flowchart of the product process.				
Benchmark 5.2	Create a product on the computer.	CIM 2.3	ELA.WHST.11-12.6	LA.12.2.1.f SC.12.1.3.a	
Sample Performance Indicator 5.2.1	Model product/project on computer in 2D.				
Sample Performance Indicator 5.2.2	Model product/project on computer in 3D.				
Benchmark 5.3	Create parts using the machines demonstrated by the instructor.	CIM 2.3	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2 SC.12.1.3.c	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Sample Performance Indicator 5.3.1	Design and fabricate a domino.				
Benchmark 5.4	Demonstrate proficiency applying proper terminology, codes and standards to the product.		ELA.WHST.11-12.6 ELA.L.11-12.6	LA.12.1.6.f LA.12.1.5	

Sample Performance Indicator 5.4.1	Assess student product using a rubric.				
Standard 6	Students will apply basic mathematics principles.	POT			
Benchmark 6.1	Use a systems approach to investigate mechanical, fluid, electrical, and thermal systems.	POT 1-12		SC.12.1.1.g	
Sample Performance Indicator 6.1.1	Apply the universal systems model to technological activities.				
Sample Performance Indicator 6.1.2	Identify the inputs, processes, outputs, and feedback associated with each of the systems.				
Benchmark 6.2	Utilize mechanical, fluid, electrical, and thermal technology safely.	POT 1-2, 9, 6, 12	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2)
Sample Performance Indicator 6.2.1	Make prudent choices in the conservation and use of resources and the disposal of materials.				
Benchmark 6.3	Apply communication, science, and mathematics knowledge and skills.		MTH.A.REI.3	MA.12.1.3.d MA.12.2.5.d SC.12.1.1.j SC.12.1.1.l	Benchmark implies a wide variety of language arts skills, depending on the specific indicators and activities used. Alignment presumes that students will perform unit conversions and select and apply appropriate methods of computation (NE: MA.12.1.3.d, MA.12.2.5.d), as well as solving linear equations in one variable (CCSS: MTH.A.REI.3), as part of applying
Sample Performance Indicator 6.3.1	Prepare technical reports and presentations.				
Sample Performance Indicator 6.3.2	Solve algebraic equations.				

Sample Performance Indicator 6.3.3	Perform unit conversions.				
Standard 7	Students will apply basic physics principles.	POT 1-4, 8			
Benchmark 7.1	Explore the laws governing motion.	POT 8	MTH.A.CED.1 MTH.A.REI.3 MTH.N.VM.3	MA.12.3.1.f MA.12.3.2.a SC.12.1.1.l SC.12.2.2.a SC.12.2.2.b SC.12.2.2.c SC.12.2.2.d SC.12.2.2.e	Alignment presumes that students will use equations, graphs, and vectors to describe motion when exploring the laws governing motion (CC: MTH.A.CED.1, MTH.A.REI.3, MTH.N.VM.3; NE: MA.12.3.1.f, MA.12.3.2.a)
Sample Performance Indicator 7.1.1	Analyze examples of uniform and accelerated motion, including linear, projectile, and circular motion.				
Sample Performance Indicator 7.1.2	Generate and interpret graphs describing motion, including the use of real time technology.				
Sample Performance Indicator 7.1.3	Develop and interpret a free-body diagram for force analysis.				
Benchmark 7.2	Describe force.	POT 1	ELA.WHST.11-12.2.b ELA.SL.11-12.4 MTH.N.VM.3	LA.12.2.1.b LA.12.3.1.a SC.12.1.1.g SC.12.2.2.c	When students <i>describe</i> information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a). Alignment presumes that students will make predictions based on balanced and unbalanced forces using vector diagrams and analyze conceptual relationships force, energy and power (CCSS: MTH.N.VM.3; NE: SC.12.1.1.g, SC.12.2.2.c)

Sample Performance Indicator 7.2.1	Analyze the relationship among force, pressure, voltage, and temperature.				
Sample Performance Indicator 7.2.2	Evaluate and predict what happens to an object when forces on it are balanced and when forces on it are unbalanced.				
Benchmark 7.3	Explore the concept of resistance.	POT 4	MTH.N.Q.1	MA.12.2.5.b MA.12.2.5.d SC.12.2.3.f	Alignment presumes that students will apply and convert appropriate units when measuring resistance (NE: MA.12.2.5.b, MA.12.2.5.d). Alignment presumes that students will measure electrical energy, including electromagnetic waves, while exploring the concept of resistance (NE: SC.12.2.3.f).
Sample Performance Indicator 7.3.1	Identify resistance in mechanical, fluid, electrical, and thermal energy systems.				
Sample Performance Indicator 7.3.2	Measure, verify, and analyze resistance in mechanical, fluid, electrical, and thermal energy systems.				