FAIRBANKS NORTH STAR BOROUGH SCHOOL DISTRICT

CAREER & TECHNICAL EDUCATION CURRICULUM

Adopted: May 13, 2014

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Science, Technology, Engineering & Mathematics

Science, Technology, Engineering & Mathematics (STEM)
Overview

The Science, Technology, Engineering and Mathematics (STEM) Cluster includes planning, managing and providing scientific research and professional and technical services (e.g., physical science, social science, engineering) including laboratory and testing services and research and development services.

The Fairbanks North Star Borough School District STEM Cluster courses may be sequenced into a variety of Programs of Study including, but not limited to:

- *Engineering & Technology*
- *Science & Math*
- *Drafting and Design*

Each school will develop Programs of Study based on availability of courses. Programs of Study are suggestions to help guide the development of individual Personal Learning Career Plans (PLCP). Students may choose courses from multiple clusters as they design a PLCP.

Many courses within this cluster are articulated for credit with University of Alaska Fairbanks/Community and Technical College through a Tech Prep agreement. This agreement allows students to earn postsecondary credit while taking a course from an approved high school instructor.

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• Tools of Tech and Trade</td><td colspan="2">• Principles of Engineering 1A/1B
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Course Information	
Course Name	**ENGINEERING DESIGN & DEVELOPMENT A**
Course Number	CTEO311
Grade(s)	12
Length	One Semester
Credit	.5
Prerequisites	Completion of three other engineering courses or Teacher Recommendation
Sequence or CTEPS (You must first have the Sequence or CTEPS entered into the system.)	STEM, Pre-Engineering
Date of District Course Revision	Spring 2014
Career & Technical Student Organization (CTSO)	
CTSO Embedded in this Sequence	N/A
Occupational Standards	
Source of Occupational Standards	Project Lead the Way (PLTW)
Names/Numbers of Occupational Standards	PLTW
Registration Information	
Course Description (brief paragraph – as shown in your student handbook or course list)	*Engineering Design & Development A* and *B* are a year long engineering research course where students will work in teams to research, design, test, and construct a solution to an open-ended engineering problem. The product development life cycle and a design process are used to guide and help the team to reach a solution to the problem. The team presents and defends their solution to a panel of outside reviewers at the conclusion of the course. This course allows students to apply all the skills and knowledge learned in previous Project Lead the Way courses. The use of 3D design software helps students design solutions to the problem their team has chosen. This course also engages students in time management and teamwork skills, a valuable set for students in the future.
Instructional Topic Headings (please separate each heading by a semi-colon)	
Summative Assessments and Standards	
Technical Skills Assessment (TSA)	Yes
Course Addresses	PLTW
Alaska ELA and Math Standards	Yes
Alaska Cultural Standards	Yes
All Aspects of Industry (AAI)	Yes
Core Technical Standards	Yes
Career Ready Practices	Yes
Employability Standards	
Source of Employability Standards	Alaska

Tech Prep	
Current Tech Prep Articulation Agreement? (Y/N)	No
Date of Current Agreement	N/A
Postsecondary Institution Name	N/A
Postsecondary Course Name	N/A
Postsecondary Course Number	N/A
Number of Postsecondary Credits	N/A
Author	
Course Developed By	PLTW
Course Adapted From	FNSBSD Curriculum
Date of Previous Course Revision	May 6, 2006
Course Delivery Model	
Is the course brokered through another institution or agency? (Y/N)	No

Standards Alignment

Student Performance Standards (Learner Outcomes or Knowledge & Skill Statements)	Specific Occupational Skills Standards	Alaska ENG/LA Standards	Alaska Math Standards	Alaska Cultural Standards	Common Technical Core Standards	Career Ready Practices	All Aspects of Industry	Formative Assessments
Students will justify why some discoveries are inventions and others are innovations.	PLTW	AS.SL.1			ST-SM.3-4	2, 4, 8	Tech/Prod	PLTW Assessments
Students will conduct patent searches and judge which patents are most relevant to a given topic.	PLTW	AS.R.10			ST-SM.3-4	6	Tech/Prod	PLTW Assessments
Students will detail ecological and sustainable design attributes of a specific product.	PLTW			A1; B3	ST-ET.1, 4		Tech/Prod	PLTW Assessments
Students will summarize research findings in visual and verbal form.	PLTW	AS.SL.1			ST-ET.1-2	2, 4	Tech/Prod	PLTW Assessments
Students will create a solution to a problem using a design process.	PLTW	AS.W.1	N.Q.1		ST-ET.1, 4-5		Business Plan	PLTW Assessments
Students will design and implement a prototype testing procedure and interpret test results.	PLTW				ST-ET.1, 4-5	6	Business Plan	PLTW Assessments
Students will develop and use a decision matrix to choose a problem statement.	PLTW				ST-SM.1-2	8	Tech/Prod	PLTW Assessments
Students will identify math and science concepts that will be or could be utilized in the process of solving an identified problem.	PLTW		N.Q.1		ST-SM.1-2		Tech/Prod	PLTW Assessments
Students will identify and describe specific criteria and constraints to the design of a product.	PLTW	AS.SL.1	N.Q.2		ST-SM.1-2; ST-ET.1, 4-5	2, 4	Tech/Prod	PLTW Assessments
Students will assess their product design based on a variety of design factors and implement design changes to improve their product.	PLTW				ST-SM.1-2; ST-ET.1, 4-5		Tech/Prod	PLTW Assessments
Students will communicate professionally with experts and mentors to obtain feedback on the technical feasibility of their product design, document the interactions, and implement recommended changes to their product design.	PLTW	AS.SL.4		A1; B3	ST-ET.2	2, 4		PLTW Assessments
Students will create a document to present their proposed design and provide justification for further development of a product.	PLTW	AS.W.1; AS.SL.4			ST-ET.2	2, 4	Business Plan	PLTW Assessments

Course Information	
Course Name	**ENGINEERING DESIGN & DEVELOPMENT B**
Course Number	CTEO312
Grade(s)	12
Length	One Semester
Credit	.5
Prerequisites	*Engineering Design & Development A* or Teacher Recommendation
Sequence or CTEPS (You must first have the Sequence or CTEPS entered into the system.)	STEM, Pre-Engineering
Date of District Course Revision	Spring 2014
Career & Technical Student Organization (CTSO)	
CTSO Embedded in this Sequence	None
Occupational Standards	
Source of Occupational Standards	Project Lead the Way (PLTW)
Names/Numbers of Occupational Standards	PLTW
Registration Information	
Course Description (brief paragraph – as shown in your student handbook or course list)	*Engineering Design & Development A* and *B* are a year long engineering research course where students will work in teams to research, design, test, and construct a solution to an open-ended engineering problem. The product development life cycle and a design process are used to guide and help the team to reach a solution to the problem. The team presents and defends their solution to a panel of outside reviewers at the conclusion of the course. This course allows students to apply all the skills and knowledge learned in previous Project Lead the Way courses. The use of 3D design software helps students design solutions to the problem their team has chosen. This course also engages students in time management and teamwork skills, a valuable set for students in the future.
Instructional Topic Headings (please separate each heading by a semi-colon)	
Summative Assessments and Standards	
Technical Skills Assessment (TSA)	Yes
Course Addresses	PLTW
Alaska ELA and Math Standards	Yes
Alaska Cultural Standards	Yes
All Aspects of Industry (AAI)	Yes
Core Technical Standards	Yes
Career Ready Practices	Yes
Employability Standards	
Source of Employability Standards	Alaska

Tech Prep	
Current Tech Prep Articulation Agreement? (Y/N)	No
Date of Current Agreement	N/A
Postsecondary Institution Name	N/A
Postsecondary Course Name	N/A
Postsecondary Course Number	N/A
Number of Postsecondary Credits	N/A
Author	
Course Developed By	PLTW
Course Adapted From	FNSBSD Curriculum
Date of Previous Course Revision	May 6, 2006
Course Delivery Model	
Is the course brokered through another institution or agency? (Y/N)	No

Standards Alignment

Student Performance Standards (Learner Outcomes or Knowledge & Skill Statements)	Specific Occupational Skills Standards	Alaska ENG/LA Standards	Alaska Math Standards	Alaska Cultural Standards	Common Technical Core Standards	Career Ready Practices	All Aspects of Industry	Formative Assessments
Students will use scientific, mathematical, and engineering concepts to design a prototype.	PLTW	ST-SM.1-2; ST-ET.1, 4-5	AS.SL.1; AS.R.10	N.Q.1	A1, B3		Tech/Prod	PLTW Assessments
Students will create an architectural program, a project organization chart, and a Gantt chart and hold project progress meetings to help manage the team project.	PLTW	ST-ET.1-2		N.Q.2		11	Tech/Prod	PLTW Assessments
Students will test, evaluate, and refine their prototypes to decide where changes must be made and document those changes.	PLTW	ST-SM.1-2; ST-ET.1, 4-5	AS.SL.1			8	Tech/Prod	PLTW Assessments
Students will prepare a description of the testing method that will be used to validate and verify the design solution.	PLTW	ST-ET.2	AS.SL.1; AS.W.1			2, 4	Tech/Prod	PLTW Assessments
Students will design and participate in a critical design review to evaluate their prototype and determine how their project will proceed.	PLTW	ST-SM.1-2; ST-ET.1-2, 4-5	AS.R.10			8	Tech/Prod	PLTW Assessments
Students will identify, define, and implement necessary modifications to their design based upon their test results.	PLTW	ST-SM.1-2; ST-ET.1-2, 4-5	AS.SL.1; AS.W.1		A1, B3	8	Tech/Prod	PLTW Assessments
Students will gather data and information compiled throughout the project and will create a project portfolio and presentation.	PLTW	ST-ET.1-2	AS.R.10	N.Q.1		8	Tech/Prod	PLTW Assessments
Students will orally present an effective technical presentation on the chosen design solution.	PLTW	ST-ET.1-2	AS.SL.4			2, 4	Tech/Prod	PLTW Assessments

Course Information	
Course Name	**INTRODUCTION TO ENGINEERING & ROBOTICS A**
Course Number	CTEO305
Grade(s)	9-12
Length	One Semester
Credit	.5
Prerequisites	None
Sequence or CTEPS (You must first have the Sequence or CTEPS entered into the system.)	Engineering
Date of District Course Revision	Spring 2014
Career & Technical Student Organization (CTSO)	
CTSO Embedded in this Sequence	
Occupational Standards	
Source of Occupational Standards	Electronics Technicians Association
Names/Numbers of Occupational Standards	SET Knowledge Competencies
Registration Information	
Course Description (brief paragraph – as shown in your student handbook or course list)	*Introduction to Engineering & Robotics A* and *B* emphasizes hands-on learning. Through the building of various projects, students will learn how to safely use certain prototyping and workshop tools, and how to apply basic engineering principles. The course introduces four main aspects of engineering: Drawing and Design using three-dimensional drawing and design software; Mechanisms and Linkages along with basic mechanical design principles; Fundamentals of Electronics and circuit construction; and Computer Programming and control of electromechanical devices. This class will include many individual and group projects. There will be a major group robotic project such as the FIRST Tech Challenge Robotics Competition and a major individual robotic project using a microcontroller such as a BASIC stamp.
Instructional Topic Headings (please separate each heading by a semi-colon)	
Summative Assessments and Standards	
Technical Skills Assessment (TSA)	None
Course Addresses	N/A
Alaska ELA and Math Standards	Yes
Alaska Cultural Standards	Yes
All Aspects of Industry (AAI)	Yes
Core Technical Standards	Yes
Career Ready Practices	Yes
Employability Standards	
Source of Employability Standards	Alaska

Tech Prep	
Current Tech Prep Articulation Agreement? (Y/N)	No
Date of Current Agreement	N/A
Postsecondary Institution Name	N/A
Postsecondary Course Name	N/A
Postsecondary Course Number	N/A
Number of Postsecondary Credits	N/A
Author	
Course Developed By	P. Timmons
Course Adapted From	FNSBSD Curriculum
Date of Previous Course Revision	Spring 2009
Course Delivery Model	
Is the course brokered through another institution or agency? (Y/N)	No

Standards Alignment

Student Performance Standards (Learner Outcomes or Knowledge & Skill Statements)	Specific Occupational Skills Standards	Alaska ENG/LA Standards	Alaska Math Standards	Alaska Cultural Standards	Common Technical Core Standards	Career Ready Practices	All Aspects of Industry	Formative Assessments
Students will learn about the *Rapid Sketching* program and how to create *Engineering Graphics*.		AS.SL.2	N.Q.1	B4	ST-ET.3	2, 8, 11	Technology	Student Activity
Students will understand *Autodesk Inventor Drawing Basics.*		AS.SL.2	N.Q.1	B4	ST-ET.3	2, 8, 11	Technology	Student Project
Students will draw basic features using *Autodesk Inventor.*		AS.SL.2	N.Q.1; N.Q.2	B4	ST-ET.3	2, 8, 11	Technology	Student Project
Students will understand assembly of parts by constraints.				B4		8		Student Activity; Teacher Observation
Students will learn basic electricity vocabulary.	1, 2	AS.R.10		B4	ST-SM.1-2; ST-ET.2			Teacher Assessment
Students will understand OHMS Law.	1.12	AS.R.10	N.Q.1; N.Q.2	B4	ST-SM.1-2	8		Formative Assessment; Teacher checks for understanding
Students will learn to measure voltage and current.	1.15		N.Q.1	B4	ST-SM.1-2			Formative Assessment
Students will learn the program *Advanced 3D Modeling.*		AS.R.10	N.Q.2	B4	ST-ET.3	2, 8, 11	Technology	Class Activity; Teacher Observation

Course Information	
Course Name	**INTRODUCTION TO ENGINEERING & ROBOTICS B**
Course Number	CTEO306
Grade(s)	9-12
Length	One Semester
Credit	.5
Prerequisites	*Introduction to Engineering & Robotics A*
Sequence or CTEPS (You must first have the Sequence or CTEPS entered into the system.)	Engineering
Date of District Course Revision	Spring 2014
Career & Technical Student Organization (CTSO)	
CTSO Embedded in this Sequence	None
Occupational Standards	
Source of Occupational Standards	Electronics Technicians Association
Names/Numbers of Occupational Standards	SET Knowledge Competencies
Registration Information	
Course Description (brief paragraph – as shown in your student handbook or course list)	*Introduction to Engineering & Robotics A* and *B* emphasizes hands-on learning. Through the building of various projects, students will learn how to safely use certain prototyping and workshop tools, and how to apply basic engineering principles. The course introduces four main aspects of engineering: In the second semester, the focus is on fundamentals of electronics and circuit construction; and computer programming and control of electromechanical devices. This class will include many individual and group projects. There will be a major group robotic project such as the FIRST Tech Challenge Robotics Competition and a major individual robotic project using a microcontroller such as a BASIC stamp.
Instructional Topic Headings (please separate each heading by a semi-colon)	
Summative Assessments and Standards	
Technical Skills Assessment (TSA)	None
Course Addresses	N/A
Alaska ELA and Math Standards	Yes
Alaska Cultural Standards	Yes
All Aspects of Industry (AAI)	Yes
Core Technical Standards	Yes
Career Ready Practices	Yes
Employability Standards	
Source of Employability Standards	Alaska

Tech Prep	
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Postsecondary Course Number	N/A
Number of Postsecondary Credits	N/A
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Course Developed By	P. Timmons
Course Adapted From	FNSBSD Curriculum
Date of Previous Course Revision	Spring 2009
Course Delivery Model	
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Standards Alignment

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Students will learn current requirements of DC motors.	10.1	AS.R.10	N.Q.1; N.Q.2		ST-SM.1-2	2		Teacher Observation; Class Activity
Students will understand vocabulary used in C Motors torque, power, RPM, speed, transmissions, bearings and shafts.		AS.R.10		B4	ST-SM.1-2			Individual Activity; Teacher Assessment
Students will learn *LabVIEW* programming.		AS.R.10	N.Q.1; N.Q.2		ST-ET.3	11	Technology	Class Activity; Lab
Students will understand how to read sensors and reactors.		AS.R.10	N.Q.1	B4	ST-ET.3	11		Teacher Observation; Formative Assessment
Students will create a FTC Robotics Project.			N.Q.2	B4	ST-ET.1, 3-5	2, 8, 11	Technology	Student Project
Students will understand Basic Stamp Microcontroller Sensors and their functions.				B4	ST-ET.3		Technology	Teacher Formative Assessment
Students will test voltage sensors through a capacitor charge/discharge rate.	2		N.Q.2	B4	ST-SM.1-2			Teacher Observation
Students will explore variable speed motor controls.			N.Q.1	B4	ST-SM.1-2	2, 8, 11		Student Project