Courses of Study
For
Electronic Engineering

Courses in the Engineering & Design Pathway

Courses:-

1. Pre-Engineering (PE) (175015)
2. Analog Based Electronic Devices (ABE) (175012)
3. AC and DC Electronic Circuits (ACDC) (175011)
4. Robotics (R) (175004)
5. Digital Electronics (DE) (175007)
6. Engineering Capstone (EC) (175009)

CTPD 023

WEST SHORE CAREER -TECHNICAL DISTRICT
LAKEWOOD, OHIO 44107

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Acknowledgements
Electronic Engineering
West Shore Career - Technical District

Sincere appreciation goes to the following individuals for their assistance and cooperation in preparing this Electronic Engineering program's course of study.

Lakewood Board of Education, Lakewood City Schools
Mr. Jeffrey Patterson, Superintendent, Lakewood City Schools
Mr. Keith Ahearn, Lakewood High School Principal
Mrs Linda Thayer, Coordinator, West Shore Career and Technical
Mr. Andre Bruwer, Instructor, Electronic Engineering

And the Electronic Engineering Advisory Committee:

Mr. Sean Arbeznik, President, Total Computer Concepts
Mr. Kyle Kasper, OSU Engineering Student
Mr. Richard Christyson, Former Parent
Mr. Eric Mondok, Avco Fire Protection
Mr. Clifford Nazelli, Retired Business Owner, PPM Instruments
Mr. Michael Clock, Business Owner, Clock Electric
Mr Joseph Rodgers, Foreman, Lakewood City Schools Technician
Mrs Donna Richmond, Retired Professor, Kent State University
Mr. Jason Chonko, Applications Engineer, Rigol Technologies

For her helpful suggestions and encouragement:
Donna Richmond, Retired Professor Kent State University

Recommendation of Advisory Committee
Electronic Engineering
West Shore Career & Technical District

The Career & Technical Advisory Committee of the Electronic Engineering Program, West Shore Career & Technical District, has reviewed this course of study and recommends it for use as the foundation for instruction in classroom, laboratory, and cooperative occupational experiences.

The developers of the course of study have considered local labor market needs and the school district's ability to offer specialized programs. The competencies found on the Electronic Engineering content standards for this program have been reviewed and accepted as being congruent with our school district's philosophy and student outcome measures.

We believe that this course of study adequately and correctly focuses upon the development of technical competencies, attitudes, values, and appreciation's critical to successful employment in the business realm.

After reviewing this document, we recommend that the Electronic Engineering course of Study be approved and adopted on _____.
(Date)

Mr Richard Christyson
(Former Parent)

Mr Kyle Kasper
(Engineering Student, OSU)

Mr Clifford Nazelli
(Retired Business Owner, PPM)

Mr Jason Chonko
(Applications Engineer, Rigol Tech.)

Mr Joseph Rodgers
(Foreman, Technician, Lakewood City Schools)

Mrs Donna Richmond
(Retired Professor, Kent State University)

Resolution
Electronic Engineering
West Shore Career & Technical District

WHEREAS, the Electronic Engineering advisory Committee of the Lakewood City Schools has reviewed the Electronic Engineering Course of Study, and WHEREAS, the course of study is based upon the Career Content Standards Competencies for Engineering and Science Technologies and courses as listed below:-

1. Pre-Engineering (PE) (175015)
2. Analog Based Electronic Devices (ABE) (175012)
3. AC and DC Electronic Circuits (ACDC) (175011)
4. Robotics (R) (175004)
5. Digital Electronics (DE) (175007)
6. Engineering Capstone (EC) (175009)

WHEREAS, the Electronic Engineering Advisory Committee has reviewed these competencies and has edited competencies to address local labor market needs, and to acknowledge the school district's ability to offer specialized programs,

NOW, THEREFORE, BE IT RESOLVED, in accordance with the superintendent's recommendation, that the *Lakewood City Schools* adopt the Electronic Engineering Course of Study.

Approval date: _____

_____ _____

Superintendent Board President

MISSION STATEMENTS
ELECTRONIC ENGINEERING
WEST SHORE CAREER AND TECHNICAL EDUCATION DISTRICT

Mission of Lakewood City Schools

In partnership with our families and community, Lakewood City Schools will develop responsible citizens, who are critical and creative thinkers, committed to life-long learning, invested in a diverse society, and prepared for technological and global opportunities.

West Shore Career Technical District Mission Statement

The many enhancements to the West Shore Career-Technical District facility, technology, and curriculum support the ongoing mission of our teachers, administration, and staff to provide excellent educational opportunities and meaningful real-world experiences while preparing students for success in the global marketplace of the 21st century.

CAREER AND TECHNICAL EDUCATION GOALS
ELECTRONIC ENGINEERING
WEST SHORE CAREER AND TECHNICAL EDUCATION DISTRICT

- Offer relevant, hands-on learning opportunities which align with student career interests and regional workforce development needs

- Prepare career-tech student for post-secondary opportunities or to directly enter the workforce.

- Maintain active advisory committees which offer overall curriculum direction and specific occupational knowledge of competencies required for each industry specific committee

- Offer career exploration opportunities to expose students to career

- Upgrade career-technical labs to align with industry standards

- Provide on-going industry training and development opportunities for career-tech staff to stay abreast of industry advancements and teaching methods.

PROGRAM DESIGN
ELECTRONIC ENGINEERING
WESTSHORE CAREER AND TECHNICAL EDUCATION DISTRICT

PROGRAM PHILOSOPHY:

We believe the Electronics program should provide all interested students with appropriate skills to make a smooth transition through the variety of educational environments into entry-level engineering fields of study whether in business or in further academic studies areas.

We believe the curriculum should have a firm basis in providing the students with the necessary communications, mathematics, science, and reasoning skills for success on the job.

We believe that the Electronics program should offer leadership and academic training necessary for further studies in the engineering field, employability opportunities, citizenship, and cooperative activities so that students may gain experience in making decisions and accepting responsibility for their actions.

We believe the program offers life-long learning skills needed to:

- survive in a technical society
- engage in entrepreneurial endeavors and maximize their potential as productive citizens

PROGRAM GOALS:

- Students will develop the skills, knowledge, attitudes, and values sufficient to secure employment and/or pursue post-secondary education in the field of their choice.
- Students will develop, expand, and refine math, science, and communication skills through application appropriate to the world of work and necessary for everyday success.
- Student will demonstrate occupational competencies at a level of proficiency acceptable to the employment market and to demonstrate the ability to adapt, retrain, and advance in an ever changing work environment.
- Students will demonstrate an understanding of positive work ethics, attitude, self-concept, and preserve mental and physical health as it relates to the processes of managing work, family, and use of leisure time.
- Students will participate in career and technical student organization activities to the extent of proved skills, knowledge, and self-concept needed for success.
- Students will demonstrate communication and basic computer operations skills to solve problems that will be encountered on a day to day basis.
- Students will receive exposure to "high tech" procedures needed to meet the demands of business and industry.
- Students will value the free enterprise system and know they are able to work as entrepreneurs as well as employers.
- Students who are educationally, economically, and/or physically disadvantaged are mainstream unless the disability prevents the student from benefiting from the program or creates a significant safety hazard to self or other students

Overview of Program ELECTRONIC ENGINEERING
Note: Six (6) individual courses for completion

The Electronic technology program at Lakewood High School is a two-year program designed for 11th and 12th grade students who are interested in pursuing post-secondary education upon graduation. The program curriculum is based on the North Coast Ohio Tech Prep Consortiums Technical Competency Profiles for Engineering Technologies. This curriculum is the result of a comprehensive review and refinement of the State's TCP Engineering Technologies document by a panel of representatives from secondary, post-secondary and business leaders.

Students are encouraged to take the right classes so that they are prepared for their next step in life. The following pathway chart is a recommended sequence for students interested in this career field.

9th Grade	10th Grade	11th Grade	12th Grade
English 1	English 2	English 3	English 4
Algebra 1 or Geometry	Geometry or Algebra II	Algebra II or Pre-Calculus	Pre-Calculus or Calculus
Biology	Physical Science	Physics	Chemistry
Health	World History	US History	Government
Music/ Art/ PE	Fine Art	Computer Programing	Social Studies
Foreign Language	Foreign Language	Pre-Engineering Technologies	Robotics
Intro to Computers		Analog Based Electronic Devices	Digital Electronics
		DC & AC Electric Circuits	Engineering Capstone

= Required Courses = Required Technical Courses = Recommended Elective

In the 11th and 12th grade component of the Tech Prep program, all students are part of a seamless curriculum, which allows student to transition into post-secondary programs. Each competency and competency builder in the required curriculum is designated to be introduced, reinforced, or mastered at various levels.

At the completion of the program each student will receive a career passport indicating competencies in which the student is proficient.

The basic instructional philosophy for the Tech Prep programs encourages project-based learning. To this end, a senior capstone project will be completed by student as a culmination of their high school exit from tech prep. An advisory committee comprised of representatives from business and industry, program graduates and academic representatives from school meets twice each year to provide input and guidance in this program.

Throughout the school year, students participate in a variety of work-based learning in order to observe and interact with employees, employers and administrative personnel in order to learn more about the industry as a whole. Early placement/ internships/ mentoring assignments/ job shadowing are all examples of work-based opportunities.

Population Served
Electronic Tech Prep program is open to all 11th and 12th grade students.

Housing of the Program
- Classroom and laboratory
- Fieldtrips to provide learning experiences outside the classroom
- Partnership with business to provide an additional hands-on training
- Early placement also provides learning experiences outside the classroom

Supervisor of the Program
The teacher of the Electronic Technology program reports directly to the West Shore Career and Technical Director.

Occupations Addressed
- Electronic Engineering Technician
- All types of Engineering Fields
- Computer Technician
- Engineering Design
- Entrepreneur

Basic Program Operation
Provide classroom instruction and laboratory experience. Develop fundamental knowledge, skills, abilities, values, and attitudes in entrepreneurship, leadership, and employability skills. Each class is 40min per period for a total of 2hrs per day and 10hrs per week.

Articulation Agreements
Articulation agreements have been developed between West Shore Career and Technical District and Cuyahoga Community College trough Tech-Prep. There is on-going dialogue following the established process and procedures between our school and each participating post-secondary institution to develop and maintain articulation agreements. The procedure can include post-secondary options, waiver of classes or other formats providing time-shortened or advanced skill associate degree paths.
West-Shore Career Tech has the following approved articulation number CTEET002. Students will get credit if they fill out an application obtainable in the CTE offices and they attend one of the approved colleges listed. To receive college credit students must maintain a 3.0 GPA in their Tech Prep programs and an overall GPA of 2.0 and maintain a 95% attendance rate.

Technology
Technology is an integral part of the Electronic Technology program. Computer hardware and software are maintained as state-of-the-art Instructional delivery of curriculum through technology is the norm for this class.

Integrated Academics
Academics are taught outside the CTE program by a licensed teacher, however, is integrated as part of this program in order to raise standards. Math, Science, English and Communications skills are essential and integral parts of the program competencies.

Student Leadership
It is anticipated that students will:
- Develop study habits commensurate with the workload
- Maintain work/note books throughout each year
- Students will have assigned supervisor roles/duties per week, these will include but will not be limited to Safety and Clean-up Supervisor
- Understand course requirements occasionally demand that students work in groups, and that the success of the group equates to the lowest common denominator

Critical Thinking and Decision Making
Develops the use of critical thinking skills in making wise decisions as an integral part of classroom instruction and laboratory learning activities
Teaches decision-making techniques through problem solving, case studies, and real life experiences

Statement of Modifications
Significant academic accommodations and/or modifications of competency to the Project Lead the Way curriculum may limit or prevent successful training and/or future employment options in this area. Also accommodations and/or modification necessary for physical limitations and/or social work behaviors may also limit or prevent successful training and/or future employment options in this area

Disclaimer Statement
This Course of Study conforms to all federal, state and local laws and regulations including Title IX and non-discrimination against any student because of race, color, creed, sex, religion, citizenship, economic status, married status, pregnancy, handicap, other physical characteristics, age or national origin. This policy of nondiscrimination shall also apply to otherwise qualify handicapped individuals.

Scope and Sequence
Pre-Engineering Technologies
175015

Course Description:
Students in the pre-engineering programs acquire knowledge and skills in problem solving, teamwork and innovation. Students explore STEM careers as they participate in a project-based learning process, designed to challenge and engage the natural curiosity and imagination of middle school students. Teams design and test their ideas using modeling, automation, robotics, mechanical and computer control systems, while exploring energy and the environment.

Scope and Sequence
Pre-Engineering Technology
West-Shore Career Tech

Strand 1. **Business Operations/21st Century Skills**
Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

Outcome **1.1 Employability Skills**
I Can … Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competencies
1.1.1. Identify the knowledge, skills and abilities necessary to succeed in careers.
1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.
1.1.3. Develop a career plan that reflects career interests, pathways and secondary and post secondary options.
1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, résumé writing, interviewing skills, portfolio development).
1.1.6. Explain the importance of work ethic, accountability and responsibility and demonstrate associated behaviors in fulfilling personal, community and workplace roles.
1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.
1.1.8. Identify the correlation between emotions, behavior and appearance and manage those to establish and maintain professionalism.
1.1.9. Give and receive constructive feedback to improve work habits.
1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.
1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.
1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits and abusive behavior.

Outcome 1.2 Leadership and Communications

I Can … Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competencies

1.2.2. Deliver formal and informal presentations.
1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.
1.2.4. Use negotiation and conflict-resolution skills to reach solutions.
1.2.5. Communicate information for an intended audience and purpose.
1.2.6. Use proper grammar and expression in all aspects of communication.
1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.
1.2.8. Identify the strengths, weaknesses and characteristics of leadership styles that influence internal and external workplace relationships.
1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications.
1.2.10. Use interpersonal skills to provide group leadership, promote collaboration and work in a team.
1.2.11. Write professional correspondence, documents, job applications and résumés.
1.2.12. Use technical writing skills to complete forms and create reports.
1.2.13. Identify stakeholders and solicit their opinions.
1.2.14. Use motivational strategies to accomplish goals.

Outcome 1.6 Business Literacy

I Can … Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

Competencies

1.6.6. Identify the target market served by the organization, the niche that the organization fills and an outlook of the industry.
1.6.7. Identify the effect of supply and demand on products and services.

Strand 2. **Electrical/Electronics**

Learners apply principles of electricity and electronics related to electronic theory, alternating and direct current, electronic components, electronic skills, digital electronics and power supplies. Knowledge and skills may be applied to fundamentals of electricity, analyzing and evaluating circuits, assembling components into electrical circuits, creating circuits to perform tasks and operations, wiring components to construct a communications system and providing power to an electrical system.

Outcome **2.1 Electronic Theory**
I Can … Explain electrical principles and theories.

Competencies
2.1.1. Describe the structure of atoms and their relationship to electricity.
2.1.2. Compare and contrast electrical and electromagnetic effect.
2.1.3. Explain methods of producing electrical current.
2.1.4. Explain how batteries store and disperse energy.
2.1.5. Compare and contrast alternating current (AC) and direct current (DC).
2.1.6. Define the units of measurement for voltage, current, power and resistance.
2.1.7. Describe the relationships between voltage, current, resistance and power in circuits.

Outcome **2.2 Circuits**
I Can … Construct and analyze alternating current circuits and direct current circuits.

Competencies
2.2.1. Compare and contrast conductors and insulators.
2.2.2. Identify common types of transformers and list uses for each.

Outcome **2.6 Digital Electronics**
I Can … Create circuits to perform tasks and operations.

Competencies
2.6.1 Determine the output frequency of circuits.
2.6.2 Describe the purpose and use of logic gates (e.g., discrete and medium scale integration, gates, latches, flip-flops).
2.6.3 Design a paradigm for combinational logic problems.

Strand 5. Pre-Engineering: Design and Development

Learners apply principles of design and development related to the design process, sketching and visualization, modeling, drafting, materials and production and process design.

** *This strand is covered extensively under the Capstone and the Pre-engineering courses and competencies are revised and retaught if needed.*

Outcome 5.1 The Design Process Digital Electronics

I Can … Use the engineering design process and quality assurance principles to analyze and solve design problems.

Competencies

5.1.1. Describe the role of research, development, and experimentation in design problem solving.
5.1.2. Conduct an investigation to identify customer needs, constraints, and criteria.
5.1.3. Develop multiple solutions and select an approach.
5.1.4. Develop a design proposal and make a model/prototype.
5.1.5. Evaluate and redesign a prototype using collected data.
5.1.8. Maintain an engineering journal to document progress and capture ideas during the development phase.

Outcome 5.3. Computer-Aided Modeling

I Can … Create models to illustrate the design of projects and components.

5.3.1. Apply manufacturing processes (e.g., casting, molding, forming, separating, conditioning, assembling, finishing, rapid prototyping).
5.3.2. Evaluate a sketch and generate a model utilizing three-dimensional modeling software and techniques.
5.3.3. Compare and contrast conceptual, physical and mathematical design models used to check proper design.
5.3.4. Perform part manipulation during the creation of an assembly model.
5.3.5. Analyze assembly constraints to successfully construct a multipart object.
5.3.6. Utilize part libraries effectively during the assembly modeling process.
5.3.7. Employ subassemblies during the production of assemblies.
5.3.8. Verify drive constraints that simulate the motion of parts in assemblies.
5.3.9. Apply adaptive design concepts during the development of sketches, features, parts and assemblies.
5.3.12. Evaluate a model for design imperfections.

Outcome 5.6. Production and Process Design
I Can … Plan, set up, monitor, analyze and control integrated systems.

Competencies
5.6.4. Identify criteria and constraints and determine how those will affect the design of the production process.
5.6.5. Estimate time, tooling, product packaging and material costs.
5.6.6. Monitor performance against time, tool and material cost estimates.

Scope and Sequence
Analog Based Electronic Devices
175012

Course Description:
Students are introduced to semiconductor diode applications, other two-terminal devices, thyristors, transistors and field effect transistors. Course includes design and analysis of transistor and FET DC bias circuitry. Operational characteristics and applications of FET and diode switching circuitry are studied. Students will examine rectifier circuits, amplifier circuits and zener voltage regulation. Emphasis is on component testing and troubleshooting.

Scope and Sequence
Analog Based Electronic Devices
West-Shore Career Tech

Strand 1. Business Operations/21st Century Skills
Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

** *This strand is covered extensively under the Capstone and the Pre-engineering courses and competencies are revised and retaught if needed.*

Outcome: 1.1. Employability Skills
I Can … Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competencies
1.1.1. Identify the knowledge, skills and abilities necessary to succeed in careers.
1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.
1.1.3. Develop a career plan that reflects career interests, pathways and secondary and postsecondary options.
1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, résumé writing, interviewing skills, portfolio development).
1.1.6. Explain the importance of work ethic, accountability and responsibility and demonstrate associated behaviors in fulfilling personal, community and workplace roles.
1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.
1.1.8. Identify the correlation between emotions, behavior and appearance and manage those to establish and maintain professionalism.
1.1.9. Give and receive constructive feedback to improve work habits.
1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.
1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.
1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits and abusive behavior.

Outcome: 1.2. Leadership and Communications

I Can … Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competencies

1.2.1. Extract relevant, valid information from materials and cite sources of information (e.g., medical reports, fitness assessment, medical test results).
1.2.2. Deliver formal and informal presentations.
1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.
1.2.4. Use negotiation and conflict-resolution skills to reach solutions.
1.2.5. Communicate information for an intended audience and purpose.
1.2.6. Use proper grammar and expression in all aspects of communication.
1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.
1.2.8. Identify the strengths, weaknesses and characteristics of leadership styles that influence internal and external workplace relationships.
1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications.
1.2.10. Use interpersonal skills to provide group leadership, promote collaboration and work in a team.
1.2.11. Write professional correspondence, documents, job applications and resumés.
1.2.12. Use technical writing skills to complete forms and create reports.
1.2.13. Identify stakeholders and solicit their opinions.
1.2.14. Use motivational strategies to accomplish goals.

Outcome: 1.3. Business Ethics and Law

I Can … Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

Competencies

1.3.1. Analyze how regulatory compliance affects business operations and organizational performance.
1.3.2. Follow protocols and practices necessary to maintain a clean, safe and healthy work environment.
1.3.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).
1.3.4. Identify how federal and state consumer protection laws affect products and services.
1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.
1.3.6. Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their overall impact on organizational performance.

1.3.7. Identify the labor and practice laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission [EEOC], human trafficking) and interpret personal safety rights according to the employee Right-to-Know Plan.
1.3.8. Verify compliance with computer and intellectual property laws and regulations.
1.3.9. Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal, organizational and professional ethical standards.

Outcome: 1.4. Knowledge Management and Information Technology
I Can … Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.

Competencies
1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).
1.4.2. Select and use software applications to locate, record, analyze and present information (e.g. word processing, e-mail, spreadsheet, databases, presentation, Internet search engines).
1.4.3. Verify compliance with security rules, regulations and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to the industry pathway.
1.4.4. Use system hardware to support software applications.
1.4.5. Use information technology tools to maintain, secure and monitor business records.
1.4.6. Use an electronic database to access and create business and technical information.
1.4.7. Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).
1.4.8. Use electronic media to communicate and follow network etiquette guidelines.

Outcome: 1.5. Global Environment

I Can … Evaluate how beliefs, values, attitudes and behaviors influence organizational strategies and goals.

Competencies

1.5.1. Describe how cultural understanding, cultural intelligence skills and continual awareness are interdependent.
1.5.2. Describe how cultural intelligence skills influence the overall success and survival of an organization.
1.5.3. Use cultural intelligence to interact with individuals from diverse cultural settings.
1.5.4. Recognize barriers in cross-cultural relationships and implement behavioral adjustments.
1.5.5. Recognize the ways in which bias and discrimination may influence productivity and profitability.
1.5.6. Analyze work tasks for understanding and interpretation from a different cultural perspective.
1.5.7. Use intercultural communication skills to exchange ideas and create meaning.
1.5.8. Identify how multicultural teaming and globalization can foster development of new and improved products and services and recognition of new opportunities.

Outcome: 1.6. Business Literacy

I Can … Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

Competencies

1.6.6. Identify the target market served by the organization, the niche that the organization fills and an outlook of the industry.
1.6.8. Identify the features and benefits that make an organization's product or service competitive.
1.6.10. Describe the impact of globalization on an enterprise or organization.
1.6.11. Describe how all business activities of an organization work within the parameters of a budget.

Strand 2. Electrical/Electronics

Learners apply principles of electricity and electronics related to electronic theory, alternating and direct current, electronic components, electronic skills, digital electronics and power supplies. Knowledge and skills may be applied to fundamentals of electricity, analyzing and evaluating circuits, assembling components into electrical circuits, creating circuits to perform tasks and operations, wiring components to construct a communications system and providing power to an electrical system.

Outcome 2.4. Electronic Components

I Can … Describe electronic components and their functions and purpose.

Competencies

2.4.1. Identify resistor values from color codes or other marks.
2.4.2. Compare and contrast resistor compositions and their uses.
2.4.3. Identify symbols for electronic components.
2.4.4. Compare and contrast negative positive negative (NPN) and positive negative positive (PNP) transistors.
2.4.5. Identify types of transistors and explain their uses (i.e., Darlington pairs, unijunction transistors, Gunn diodes, field effect transistors [FETs] and metal-oxide semiconductor field effect transistor [MOSFETs], N- and P- channel junction field effect transistors [JFETs]).
2.4.6. Compare and contrast the purpose and function of thyristors (diacs, triacs, varisters and thermistors).
2.4.7. Describe the purpose and operation of zener diodes.
2.4.8. Describe the purpose and operation of common optical devices (e.g., light emitting diodes [LEDs], liquid crystal displays [LCDs]).
2.4.9. Describe the purpose and operation of photovoltaic cells.
2.4.10. Describe the purpose, composition and operation of photo resistors, photodiodes and phototransistors.
2.4.11. Define surface mount components.

Outcome 2.5. Electronic Soldering Connections

I Can … Connect individual components into an electrical unit.

Competencies

2.5.1 Define the purpose of a connection and the differences between a good and bad connection.
2.5.2 Select types of solder.
2.5.3 Describe methods for soldering and desoldering and the purpose for each method.
2.5.4 Protect circuit boards from electrostatic discharge (ESD).
2.5.5 Solder and desolder components.
2.5.6 Combine components per wiring prints, schematics and block diagrams.

Outcome 2.8. Power Supplies
I Can … Provide power to electrical circuits.

Competencies
2.8.1 Identify the differences between transformer-powered supplies and line-connected supplies.
2.8.2 Select a battery based on composition, environment and circuit characteristics.
2.8.4 Construct and install regulated power supplies.
2.8.5 Select and install fuses and circuit breakers.
2.8.6 Select and construct half-wave, full-wave and bridge rectifiers.
2.8.7 Select and install power conditioning, isolation transformers, surge suppressors and uninterruptible power supplies.

Outcome: 6.1. Measurement and Interpretation
I Can … Interpret drawings and documentation and perform measurements.

Competencies
6.1.3. Identify measuring systems and convert between systems.
6.1.5. Identify information and symbols typically provided in drawings and specifications.

Strand 7. Safety, Tools and Equipment
Learners apply principles of protection, prevention and mitigation to create and maintain safe working conditions at manufacturing sites. Knowledge and skills may be applied in all aspects of personal and site safety, including handling materials, using tools and equipment, working with and around electricity and using personal protective equipment.

Outcome 7.1. Site Safety
I Can … Handle materials, prevent accidents and mitigate hazards.

Competencies
7.1.1. Use Occupational Safety and Health Administration (OSHA)-defined procedures for identifying employer and employee responsibilities, working in confined spaces, managing worker safety programs, using ground fault circuit interrupters (GFCIs), maintaining clearance and
boundaries and labeling.
7.1.2. Identify and rectify or mitigate hazards associated with walking surfaces, working surfaces and lighting.
7.1.6. Identify source of electrical and mechanical hazards and use shut-down and established lock out/tag-out procedures.
7.1.7. Identify and eliminate worksite clutter in accordance with standards for cleanliness and safety.
7.1.8. Identify procedures for the handling, storage and disposal of hazardous materials.

7.1.9. Identify the location of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits.
7.1.10. Select and operate fire extinguishers based on the class of fire.
7.1.11. Identify the components of a hazardous materials safety plan.
7.1.13. Set up for ergonomic workflow.

Outcome 7.2. Personal Safety
I Can … Practice personal safety.

Competencies
7.2.1. Interpret personal safety rights according to the employee Right to Know plan.
7.2.2. Describe how working under the influence of drugs and alcohol increases the risk of accident, lowers productivity, raises insurance costs and reduces profits.
7.2.3. Select, use, store, maintain and dispose of personal protective equipment (PPE) appropriate to job tasks, conditions and materials.
7.2.4. Identify workplace risk factors associated with lifting, operating and moving heavy objects and establish an ergonomics process.
7.2.5. Identify, inspect and use safety equipment appropriate for a task.
7.2.6. Use safe practices when working with electrical, mechanical, or other equipment.

Scope and Sequence
DC and AC Electronic Circuits
175011

Course Description:
Students will learn the fundamental principles of electricity with emphasis on DC (direct current) circuits and an introduction to AC (alternating current) circuits. They will use concepts of Ohm's Law, the Power Formula, and Kirchoff's Laws with series, parallel, and series-parallel circuit applications. The relationship between electricity and magnetism and motor theory will also be introduced. The student will use and maintain digital multimeters and oscilloscopes.

Scope and Sequence
DC & AC Electronic Circuits
West-Shore Career Tech

Strand 1. Business Operations/21st Century Skills
Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

** *This strand is covered extensively under the Capstone and the Pre-engineering courses and competencies are revised and retaught if needed.*

Outcome: 1.1. Employability Skills
I Can … Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competencies
1.1.1. Identify the knowledge, skills and abilities necessary to succeed in careers.
1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.
1.1.3. Develop a career plan that reflects career interests, pathways and secondary and postsecondary options.
1.1.4. Describe the role and function of professional organizations, industry associations and organized labor and use networking techniques to develop and maintain professional relationships.
1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, résumé writing, interviewing skills, portfolio development).
1.1.6. Explain the importance of work ethic, accountability and responsibility and demonstrate associated behaviors in fulfilling personal, community and workplace roles.
1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.
1.1.8. Identify the correlation between emotions, behavior and appearance and manage those to establish and maintain professionalism.
1.1.9. Give and receive constructive feedback to improve work habits.
1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.
1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.
1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits and abusive behavior.

Outcome: 1.2. Leadership and Communications

I Can … Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competencies

1.2.1. Extract relevant, valid information from materials and cite sources of information (e.g., medical reports, fitness assessment, medical test results).
1.2.2. Deliver formal and informal presentations.
1.2.3. Identify and use verbal, nonverbal and active listening skills to communicate effectively.
1.2.4. Use negotiation and conflict-resolution skills to reach solutions.
1.2.5. Communicate information for an intended audience and purpose.
1.2.6. Use proper grammar and expression in all aspects of communication.
1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.
1.2.8. Identify the strengths, weaknesses and characteristics of leadership styles that influence internal and external workplace relationships.
1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications.
1.2.10. Use interpersonal skills to provide group leadership, promote collaboration and work in a team.
1.2.11. Write professional correspondence, documents, job applications and resumés.
1.2.12. Use technical writing skills to complete forms and create reports.
1.2.13. Identify stakeholders and solicit their opinions.
1.2.14. Use motivational strategies to accomplish goals.

Outcome: 1.3. Business Ethics and Law

I Can … Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

Competencies

1.3.1. Analyze how regulatory compliance affects business operations and organizational performance.
1.3.2. Follow protocols and practices necessary to maintain a clean, safe and healthy work environment.
1.3.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).
1.3.4. Identify how federal and state consumer protection laws affect products and services.
1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.
1.3.6. Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their overall impact on organizational performance.

1.3.7. Identify the labor and practice laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission [EEOC], human trafficking) and interpret personal safety rights according to the employee Right-to-Know Plan.
1.3.8. Verify compliance with computer and intellectual property laws and regulations.
1.3.9. Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal, organizational and professional ethical standards.

Outcome: 1.4. Knowledge Management and Information Technology

I Can … Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.

Competencies

1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).
1.4.2. Select and use software applications to locate, record, analyze and present information (e.g., word processing, e-mail, spreadsheet, databases, presentation, Internet search engines).
1.4.3. Verify compliance with security rules, regulations and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to the industry pathway.
1.4.4. Use system hardware to support software applications.
1.4.5. Use information technology tools to maintain, secure and monitor business records.
1.4.6. Use an electronic database to access and create business and technical information.
1.4.7. Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).
1.4.8. Use electronic media to communicate and follow network etiquette guidelines.

Outcome: 1.5. Global Environment

I Can … Evaluate how beliefs, values, attitudes and behaviors influence organizational strategies and goals.

Competencies

1.5.1. Describe how cultural understanding, cultural intelligence skills and continual awareness are interdependent.
1.5.2. Describe how cultural intelligence skills influence the overall success and survival of an organization.
1.5.3. Use cultural intelligence to interact with individuals from diverse cultural settings.
1.5.4. Recognize barriers in cross-cultural relationships and implement behavioral adjustments.
1.5.5. Recognize the ways in which bias and discrimination may influence productivity and profitability.
1.5.6. Analyze work tasks for understanding and interpretation from a different cultural perspective.
1.5.7. Use intercultural communication skills to exchange ideas and create meaning.
1.5.8. Identify how multicultural teaming and globalization can foster development of new and improved products and services and recognition of new opportunities.

Outcome: 1.9. Financial Management

I Can … Use financial tools, strategies and systems to develop, monitor and control the use of financial resources to ensure personal and business financial well-being.

Competencies

1.9.1. Create, analyze and interpret financial documents (e.g., budgets, income statements).
1.9.2. Identify tax obligations.
1.9.3. Review and summarize savings, investment strategies and purchasing options (e.g., cash, lease, finance, stocks, bonds).
1.9.4. Identify credit types and their uses in order to establish credit.
1.9.5. Identify ways to avoid or correct debt problems (e.g., collection agency payments and post collection agency payments).
1.9.6. Explain how credit ratings and the criteria lenders use to evaluate repayment capacity affect access to loans.
1.9.7. Review and summarize categories (types) of insurance and identify how insurances can reduce financial risk.
1.9.8. Identify income sources and expenditures.
1.9.9. Compare and contrast different banking services available through financial institutions.
1.9.10. Identify the role of depreciation in tax planning and liability.

Strand 2. **Electrical/Electronics**

Learners apply principles of electricity and electronics related to electronic theory, alternating and direct current, electronic components, electronic skills, digital electronics and power supplies. Knowledge and skills may be applied to fundamentals of electricity, analyzing and evaluating circuits, assembling components into electrical circuits, creating circuits to perform tasks and operations, wiring components to construct a communications system and providing power to an electrical system.

Outcome: **2.1. Electronic Theory**

I Can … Explain electrical principles and theories.

Competencies

2.1.1. Describe the structure of atoms and their relationship to electricity.
2.1.2. Compare and contrast electrical and electromagnetic effect.
2.1.3. Explain methods of producing electrical current.
2.1.4. Explain how batteries store and disperse energy.
2.1.5. Compare and contrast alternating current (AC) and direct current (DC).
2.1.6. Define the units of measurement for voltage, current, power and resistance.
2.1.7. Describe the relationships between voltage, current, resistance and power in circuits.
2.1.8. Determine voltage, current, resistance and power in circuits using Ohm's Law, Kirchhoff's Law and Watt's Law.
2.1.9. Describe the purpose of grounding and common methods used for grounding.
2.1.10. Evaluate frequency and phase.
2.1.11. Identify methods of varying capacitance.
2.1.12. Calculate true power, apparent power, reactive power and power factor.
2.1.13. Determine impedance.
2.1.14. Compare peak (PK), root mean square (RMS) and average voltage.
2.1.15. Apply theorems of circuit analysis (i.e., superposition theorem, Thévenin's Theorem, Norton's Theorem , maximum power transfer theorem, substitution theorem, Millman's Theorem, reciprocity theorem). *(Updated 25 AUG 2014)*
2.1.16. Apply Mesh or Nodal Analysis Techniques to find currents through and voltage drops across all resistors in a complex circuit (three or more loops). *(Updated 25 AUG 2014)*

Outcome: 2.2. Circuits

I Can … Construct and analyze alternating current (AC) circuits and direct current (DC) circuits.

Competencies

2.2.1. Compare and contrast conductors and insulators.
2.2.2. Identify common types of transformers and list uses for each.
2.2.3. Explain step-up/step-down voltage methods.
2.2.4. Describe lamination and explain why laminations are used.
2.2.5. Identify types of capacitors and common usages for each.
2.2.6. Identify types of inductors and explain the purposes of different core materials.
2.2.7. Identify the function of inductors and capacitors in series and parallel circuits.
2.2.8. Explain the uses of series, parallel and series-parallel circuits.
2.2.9. Construct and troubleshoot series, parallel and series-parallel circuits.
2.2.10. Analyze wiring schematics and diagrams for accuracy and function.
2.2.11. Apply the universal time constant curve in an R-L circuit and R-C circuit. (*Updated 25 AUG 2014)*
2.2.12. Solve for voltage, current, and time in a R-C and R-L circuit using exponential equations. *(Updated 25 AUG 2014)*
2.2.13. Determine the transience due to inductors using a series RLC circuit. *(Updated 25 AUG 2014)*

Outcome 2.3. Codes and Regulations

I Can … Explain and apply the National Electrical Code (NEC) and other building codes.

Competencies

2.3.1. Explain the role of Underwriters Laboratory (UL), Canadian Standards Association (CSA) and Intertek Testing Service/Edison Testing Laboratory (ITS/ETL).
2.3.2. Locate and apply the information in articles of the NEC and other applicable codes (i.e., Building Officials and Code Administrators [BOCA], Ohio Building Code [OBC], Life Safety Codes) and explain how they impact job requirements (e.g., service conductors, feeders, branch circuits, overload protection, grounding, bonding requirements).
2.3.3. Utilize National Fire Protection Association (NFPA) procedures for NFPA 70E-arc flash boundaries, current-limiting fuses, live work power permits, electrically safe work conditions, emergency worker safety programs, scheduling, energized circuits and training.

Outcome 2.4. Electronic Components
I Can … Describe electronic components and their functions and purpose.

Competencies
2.4.1. Identify resistor values from color codes or other marks.
2.4.2. Compare and contrast resistor compositions and their uses.
2.4.3. Identify symbols for electronic components.
2.4.4. Compare and contrast negative positive negative (NPN) and positive negative positive (PNP) transistors.
2.4.5. Identify types of transistors and explain their uses (i.e., Darlington pairs, unijunction transistors, Gunn diodes, field effect transistors [FETs] and metal-oxide semiconductor field effect transistor [MOSFETs], N- and P- channel junction field effect transistors [JFETs]).
2.4.6. Compare and contrast the purpose and function of thyristors (diacs, triacs, varisters and thermistors).
2.4.7. Describe the purpose and operation of zener diodes.
2.4.8. Describe the purpose and operation of common optical devices (e.g., light emitting diodes [LEDs], liquid crystal displays [LCDs]).
2.4.9. Describe the purpose and operation of photovoltaic cells.
2.4.10. Describe the purpose, composition and operation of photo resistors, photodiodes and phototransistors.
2.4.11. Define surface mount components.
2.4.12. Describe the purpose and operation of audio amplifiers and their frequency response.
2.4.13. Explain the purpose and operation of common emitter (CE) amplifiers, common base (CB) amplifiers and common collector (CC) or emitter follower amplifiers.

Strand 5. Pre-Engineering: Design and Development
Learners apply principles of design and development related to the design process, sketching and visualization, modeling, drafting, materials and production and process design.

** *This strand is covered extensively under the Capstone course and competencies are revised and retaught if needed.*

Outcome: 6.1. Measurement and Interpretation
I Can … Interpret drawings and documentation and perform measurements.

Competencies
6.1.3. Identify measuring systems and convert between systems.
6.1.5. Identify information and symbols typically provided in drawings and specifications.

Strand 7. Safety, Tools and Equipment

Learners apply principles of protection, prevention and mitigation to create and maintain safe working conditions at manufacturing sites. Knowledge and skills may be applied in all aspects of personal and site safety, including handling materials, using tools and equipment, working with and around electricity and using personal protective equipment.

Outcome 7.1. Site Safety

I Can … Handle materials, prevent accidents and mitigate hazards.

Competencies

7.1.1. Use Occupational Safety and Health Administration (OSHA)-defined procedures for identifying employer and employee responsibilities, working in confined spaces, managing worker safety
programs, using ground fault circuit interrupters (GFCIs), maintaining clearance and boundaries and labeling.

7.1.2. Identify and rectify or mitigate hazards associated with walking surfaces, working surfaces and lighting.

7.1.3. Calculate example of load factors for constructing scaffolding, railings, ladders and temporary structures.

7.1.6. Identify source of electrical and mechanical hazards and use shut-down and established lock out/tag-out procedures.

7.1.7. Identify and eliminate worksite clutter in accordance with standards for cleanliness and safety.

7.1.8. Identify procedures for the handling, storage and disposal of hazardous materials.

7.1.9. Identify the location of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits.

7.1.10. Select and operate fire extinguishers based on the class of fire.

7.1.11. Identify the components of a hazardous materials safety plan.

7.1.13. Set up for ergonomic workflow.

Outcome 7.2. Personal Safety

I Can … Practice personal safety.

Competencies

7.2.1. Interpret personal safety rights according to the employee Right to Know plan.

7.2.2. Describe how working under the influence of drugs and alcohol increases the risk of accident, lowers productivity, raises insurance costs and reduces profits.

7.2.3. Select, use, store, maintain and dispose of personal protective equipment (PPE) appropriate to job tasks, conditions and materials.

7.2.4. Identify workplace risk factors associated with lifting, operating and moving heavy objects and establish an ergonomics process.

7.2.5. Identify, inspect and use safety equipment appropriate for a task.

7.2.6. Use safe practices when working with electrical, mechanical, or other equipment.

Scope and Sequence
Robotics
175004

Course Description:
Students will apply the knowledge and skills necessary to program and operate Robots, using the teach pendant as the main interface point. The Students will learn robotic operations and system configurations. Students will code, compile, and debug programs using the robotic programming language.

Scope and Sequence
Robotics
West-Shore Career Tech

Strand 1. Business Operations/21st Century Skills
Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

** *This strand is covered extensively under the Capstone and the Pre-engineering courses and competencies are revised and retaught if needed.*

Outcome: 1.1. Employability Skills:
I Can … Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competencies
1.1.1. Identify the knowledge, skills, and abilities necessary to succeed in careers.
1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure, and experience.
1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, résumé writing, interviewing skills, portfolio development).
1.1.6. Explain the importance of work ethic, accountability, and responsibility and demonstrate associated behaviors in fulfilling personal, community, and workplace roles.
1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.
1.1.8. Identify the correlation between emotions, behavior, and appearance and manage those to establish and maintain professionalism.
1.1.9. Give and receive constructive feedback to improve work habits.
1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.
1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.
1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits, and abusive behavior.

Outcome: 1.2. Leadership and Communications:
I Can … Process, maintain, evaluate, and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competencies
1.2.1. Extract relevant, valid information from materials and cite sources of information.
1.2.2. Deliver formal and informal presentations.
1.2.3. Identify and use verbal, nonverbal, and active listening skills to communicate effectively.

1.2.4. Use negotiation and conflict-resolution skills to reach solutions.
1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.
1.2.6. Use proper grammar and expression in all aspects of communication.
1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.
1.2.8. Identify the strengths, weaknesses, and characteristics of leadership styles that influence internal and external workplace relationships.
1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications (e.g., common content for large audience, control of tone, speed, cost, lack of non-verbal cues, potential for forwarding information, longevity).
1.2.10. Use interpersonal skills to provide group leadership, promote collaboration, and work in a team.
1.2.11. Write professional correspondence, documents, job applications, and résumés.
1.2.12. Use technical writing skills to complete forms and create reports.
1.2.13. Identify stakeholders and solicit their opinions.
1.2.14. Use motivational strategies to accomplish goals.

Outcome: 1.3. Business Ethics and Law:

I Can … Analyze how professional, ethical, and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

Competencies

1.3.1. Analyze how regulatory compliance affects business operations and organizational performance.
1.3.2. Follow protocols and practices necessary to maintain a clean, safe, and healthy work environment.
1.3.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).
1.3.4. Identify how federal and state consumer protection laws affect products and services.
1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], U.S. Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.
1.3.7. Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission).
1.3.8. Verify compliance with computer, copyright, and intellectual property laws and regulations.
1.3.9. Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal, organizational, and professional ethical standards.

Outcome: 1.4. Knowledge Management and Information Technology:

I Can … Demonstrate current and emerging strategies and technologies used to collect, analyze, record, and share information in business operations.

Competencies

1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).
1.4.2. Select and use software applications to locate, record, analyze, and present information (e.g., word processing, electronic mail, spreadsheet, databases, presentation, Internet search engines).
1.4.3. Verify compliance with security rules, regulations, and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to industry pathway.
1.4.4. Use system hardware to support software applications.
1.4.5. Use information technology tools to maintain, secure, and monitor business records.
1.4.6. Use electronic database to access and create business and technical information.
1.4.7. Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).
1.4.8. Use electronic media to communicate and follow network etiquette guidelines.

Outcome: 1.5. Global Environment:

I Can … Evaluate how beliefs, values, attitudes, and behaviors influence organizational strategies and goals.

Competencies

1.5.1. Describe how cultural understanding, cultural intelligence skills, and continual awareness are interdependent.
1.5.2. Describe how cultural intelligence skills influence the overall success and survival of an organization.
1.5.3. Use cultural intelligence to interact with individuals from diverse cultural settings.
1.5.4. Recognize barriers in cross-cultural relationships and implement behavioral adjustments.
1.5.5. Recognize the ways in which bias and discrimination may influence productivity and profitability.
1.5.6. Analyze work tasks for understanding and interpretation from a different cultural perspective.
1.5.7. Use intercultural communication skills to exchange ideas and create meaning.
1.5.8. Identify how multicultural teaming and globalization can foster development of new and improved products and services and recognition of new opportunities.

Outcome: 1.6. Business Literacy:

I Can … Develop foundational skills and knowledge in entrepreneurship, financial literacy, and business operations.

Competencies

1.6.1. Identify business opportunities.
1.6.2. Assess the reality of becoming an entrepreneur, including advantages and disadvantages (e.g., risk vs. reward, reasons for success and failure).
1.6.3. Explain the importance of planning your business.
1.6.4. Identify types of businesses, ownership, and entities (i.e., individual proprietorships, partnerships, corporations, cooperatives, public, private, profit, not-for-profit).
1.6.5. Describe organizational structure, chain of command, the roles and responsibilities of the organizational departments, and interdepartmental interactions.
1.6.6. Identify the target market served by the organization, the niche that the organization fills, and outlook of the industry.
1.6.7. Identify the effect of supply and demand on products and services.
1.6.8. Identify the features and benefits that make an organization's product or service competitive.
1.6.9. Explain how the performance of an employee, a department, and an organization is assessed.
1.6.10. Describe the impact of globalization on an enterprise or organization.
1.6.11. Describe how all business activities of an organization work within the parameters of a budget.
1.6.12. Describe classifications of employee benefits, rights, deductions, and compensations.

Strand 2. Electrical/Electronics

Learners apply principles of electricity and electronics related to electronic theory, alternating and direct current, electronic components, electronic skills, digital electronics and power supplies. Knowledge and skills may be applied to fundamentals of electricity, analyzing and evaluating circuits, assembling components into electrical circuits, creating circuits to perform tasks and operations, wiring components to construct a communications system and providing power to an electrical system.

Outcome: 2.1 Electronic Theory:
I Can … Explain electrical principles and theories.

Competencies

2.1.1 Describe the structure of atoms and their relationship to electricity.
2.1.2 Compare and contrast electrical and electromagnetic effect.
2.1.3 Explain methods of producing electrical current.
2.1.4 Explain how batteries store and disperse energy.
2.1.5 Compare and contrast alternating current (AC) and direct current (DC).
2.1.6 Define the units of measurement for voltage, current, power, and resistance.
2.1.7 Describe the relationships between voltage, current, resistance, and power in circuits.
2.1.8 Determine voltage, current, resistance, and power in circuits using Ohm's Law, Kirchhoff's Law, and Watt's Law.
2.1.9 Describe the purpose of grounding and common methods used for grounding.
2.1.10 Evaluate frequency and phase.
2.1.11 Identify methods of varying capacitance.
2.1.12 Calculate true power, apparent power, reactive power, and power factor.
2.1.13 Determine impedance.
2.1.14 Compare peak (PK), root mean square (RMS), and average values.

Outcome: 2.2. Circuits:
I Can … Construct and analyze alternating current circuits and direct current circuits.

Competencies

2.2.8 Explain the uses of series, parallel, and series-parallel circuits.
2.2.9 Construct and troubleshoot series, parallel, and series-parallel circuits.
2.2.10 Analyze wiring schematics and diagrams for accuracy and function.

Outcome: 2.3 Codes and Regulations:
I Can … Explain and apply the National Electrical Code (NEC) and other building codes.

Competencies

2.3.1. Explain the role of Underwriters Laboratory (UL), Canadian Standards Association (CSA), and Intertek Testing Service/Edison Testing Laboratory (ITS/ETL).

Outcome: 2.6 Digital Electronics:
I Can … Create circuits to perform tasks and operations.

Competencies
2.6.5 Describe the purpose and operation of programmable logic devices (PLDs) and complex programmable logic devices (CPLDs).
2.6.6 Describe the purpose and use of asynchronous and synchronous counters.
2.6.8 Explain the purpose and use of a digital bus.
2.6.10. Identify the numbering systems, codes, arithmetic operations, Boolean operations, and simplification methods used in digital electronics.

Outcome: 2.7 Cabling and Wiring:
I Can … Connect components to construct low-voltage, data, and communication systems using coaxial or fiber optic cables and twisted pair or balanced wires.

Competencies
2.7.1. Describe the types, purposes, and uses of cables and wires.
2.7.2. Identify the construction, impedance characteristics, and use of cables and wires.
2.7.3. Explain how the characteristics of cables and wires cause impedance.
2.7.4. Select methods for splicing and terminating cables and wires.
2.7.5. Splice and terminate cables and wires.
2.7.6. Test cables and wires.

Outcome: 2.8 Power Supplies:
I Can … Provide power to electrical circuits.

Competencies
2.8.1 Identify the differences between transformer-powered supplies and line-connected supplies.
2.8.2 Select a battery based on composition, environment, and circuit characteristics.
2.8.4 Construct and install regulated power supplies.

Outcome: 2.9. Motors and Power:
I Can … Install motors and power wiring in accordance with the National Electrical Code.

Competencies
2.9.9. Describe how programmable controllers can be used in single phase and three phase circuits.

Strand 3. Computer Integrated Manufacturing

Learners apply the principles of computer integrated manufacturing related to computer numerical control, robotics, programmable logic controllers and power systems.

Outcome: 3.2. Robotics:

I Can … Plan and operate robotics production processes.

Competencies

3.2.1. Identify the components of a robot system and explain their roles in the robot's operation cycle.
3.2.2. Maintain robot components and controllers.
3.2.3. Use the robotic systems classification scheme to select an industrial robot.
3.2.4. Use job specifications to create programs for robot operations, sensors, and feeder systems.
3.2.5. Plan, program, and test a robotic work cell using teach pendant and simulation software.
3.2.6. Identify the robot's payload and identify the concepts of payload weight, moment, and inertia to select an appropriate robot.
3.2.7. Use robot speed specifications to calculate estimated cycle times for sample tasks.
3.2.8. Identify home position (fixed and floating zero) using absolute and incremental coordinates.
3.2.9. Compare and contrast various robotic applications and processes (e.g., pick and place, welding).
3.2.10. Identify the robot's work envelope and apply the concepts of reach and articulation to evaluate whether a robot is suited to an application.
3.2.11. Analyze the performance and troubleshoot the operation of a robotic cell.

Outcome: 3.3. Programmable Logic Controllers (PLCs):

I Can … Program digital computers used for automation of electromechanical processes to perform tasks.

Competencies

3.3.1. Identify PLCs.
3.3.2. Design a PLC program using timers, counters, and sequencers. (*Updated 28 AUG 2014*)
3.3.3. Describe the use of PLCs in manufacturing automation.
3.3.4. Apply and execute ladder logic programs. (Updated 28 AUG 2014)
3.3.5. Design a motor control program using manual and automatic modes.
3.3.6. Monitor and troubleshoot a hard-wired system with a PLC.
3.3.7. Monitor PLC operation using systems control dialog.

Scope and Sequence
Digital Electronics
175007

Course Description:
Students are introduced to the process of combinational and sequential logic design. The system uses a precise sequence of discrete voltages, representing numbers, non-numeric symbols or commands for input, processing, transmission, storage, or display. Engineering standards and methods for technical documentation will also be learned.

Scope and Sequence
Digital Electronics
West-Shore Career Tech

Strand 1. Business Operations/21st Century Skills
Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

** *This strand is covered extensively under the Capstone and the Pre-engineering courses and competencies are revised and retaught if needed.*

Outcome: 1.1. Employability Skills:
I Can … Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competencies
1.1.1. Identify the knowledge, skills, and abilities necessary to succeed in careers.
1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure, and experience.
1.1.3. Develop a career plan that reflects career interests, pathways, and secondary and postsecondary options.
1.1.5. Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, résumé writing, interviewing skills, portfolio development).
1.1.6. Explain the importance of work ethic, accountability, and responsibility and demonstrate associated behaviors in fulfilling personal, community, and workplace roles.
1.1.7. Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.
1.1.8. Identify the correlation between emotions, behavior, and appearance and manage those to establish and maintain professionalism.
1.1.9. Give and receive constructive feedback to improve work habits.
1.1.10. Adapt personal coping skills to adjust to taxing workplace demands.
1.1.11. Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.
1.1.12. Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits, and abusive behavior.

Outcome: **1.2. Leadership and Communications:**

I Can … Process, maintain, evaluate, and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competencies

1.2.1. Extract relevant, valid information from materials and cite sources of information.
1.2.2. Deliver formal and informal presentations.
1.2.3. Identify and use verbal, nonverbal, and active listening skills to communicate effectively.
1.2.4. Use negotiation and conflict-resolution skills to reach solutions.
1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.
1.2.6. Use proper grammar and expression in all aspects of communication.
1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.
1.2.8. Identify the strengths, weaknesses, and characteristics of leadership styles that influence internal and external workplace relationships.
1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications (e.g., common content for large audience, control of tone, speed, cost, lack of non-verbal cues, potential for forwarding information, longevity).
1.2.10. Use interpersonal skills to provide group leadership, promote collaboration, and work in a team.
1.2.11. Write professional correspondence, documents, job applications, and résumés.
1.2.12. Use technical writing skills to complete forms and create reports.
1.2.13. Identify stakeholders and solicit their opinions.
1.2.14. Use motivational strategies to accomplish goals.

Outcome: **1.3. Business Ethics and Law:**

I Can … Analyze how professional, ethical, and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

Competencies

1.3.1. Analyze how regulatory compliance affects business operations and organizational performance.
1.3.2. Follow protocols and practices necessary to maintain a clean, safe, and healthy work environment.
1.3.3. Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).
1.3.4. Identify how federal and state consumer protection laws affect products and services.
1.3.5. Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], U.S. Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.

1.3.6. Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their overall impact on organizational performance.
1.3.7. Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission).
1.3.8. Verify compliance with computer, copyright, and intellectual property laws and regulations.
1.3.9. Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal, organizational, and professional ethical standards.

Outcome: 1.4. Knowledge Management and Information Technology:
I Can … Demonstrate current and emerging strategies and technologies used to collect, analyze, record, and share information in business operations.

Competencies
1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).
1.4.2. Select and use software applications to locate, record, analyze, and present information (e.g., word processing, electronic mail, spreadsheet, databases, presentation, Internet search engines).
1.4.3. Verify compliance with security rules, regulations, and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to industry pathway.
1.4.4. Use system hardware to support software applications.
1.4.5. Use information technology tools to maintain, secure, and monitor business records.
1.4.6. Use electronic database to access and create business and technical information.
1.4.7. Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).
1.4.8. Use electronic media to communicate and follow network etiquette guidelines.

Outcome: 1.5. Global Environment:
I Can … Evaluate how beliefs, values, attitudes, and behaviors influence organizational strategies and goals.

Competencies
1.5.1. Describe how cultural understanding, cultural intelligence skills, and continual awareness are interdependent.
1.5.2. Describe how cultural intelligence skills influence the overall success and survival of an organization.
1.5.3. Use cultural intelligence to interact with individuals from diverse cultural settings.
1.5.4. Recognize barriers in cross-cultural relationships and implement behavioral adjustments.

1.5.5. Recognize the ways in which bias and discrimination may influence productivity and profitability.
1.5.6. Analyze work tasks for understanding and interpretation from a different cultural perspective.
1.5.7. Use intercultural communication skills to exchange ideas and create meaning.
1.5.8. Identify how multicultural teaming and globalization can foster development of new and improved products and services and recognition of new opportunities.

Outcome: 1.6. Business Literacy:
I Can … Develop foundational skills and knowledge in entrepreneurship, financial literacy, and business operations.

Competencies
1.6.1. Identify business opportunities.
1.6.2. Assess the reality of becoming an entrepreneur, including advantages and disadvantages (e.g., risk vs. reward, reasons for success and failure).
1.6.3. Explain the importance of planning your business.
1.6.4. Identify types of businesses, ownership, and entities (i.e., individual proprietorships, partnerships, corporations, cooperatives, public, private, profit, not-for-profit).
1.6.5. Describe organizational structure, chain of command, the roles and responsibilities of the organizational departments, and interdepartmental interactions.
1.6.6. Identify the target market served by the organization, the niche that the organization fills, and outlook of the industry.
1.6.7. Identify the effect of supply and demand on products and services.
1.6.8. Identify the features and benefits that make an organization's product or service competitive.
1.6.9. Explain how the performance of an employee, a department, and an organization is assessed.
1.6.10. Describe the impact of globalization on an enterprise or organization.
1.6.11. Describe how all business activities of an organization work within the parameters of a budget.
1.6.12. Describe classifications of employee benefits, rights, deductions, and compensations.

Strand 2. Electrical/Electronics

Learners apply principles of electricity and electronics related to electronic theory, alternating and direct current, electronic components, electronic skills, digital electronics and power supplies. Knowledge and skills may be applied to fundamentals of electricity, analyzing and evaluating circuits, assembling components into electrical circuits, creating circuits to perform tasks and operations, wiring components to construct a communications system and providing power to an electrical system.

Outcome: 2.1 Electronic Theory:
I Can … Explain electrical principles and theories.

Competencies

2.1.1 Describe the structure of atoms and their relationship to electricity.
2.1.2 Compare and contrast electrical and electromagnetic effect.
2.1.3 Explain methods of producing electrical current.
2.1.4 Explain how batteries store and disperse energy.
2.1.5 Compare and contrast alternating current (AC) and direct current (DC).
2.1.6 Define the units of measurement for voltage, current, power, and resistance.
2.1.7 Describe the relationships between voltage, current, resistance, and power in circuits.
2.1.8 Determine voltage, current, resistance, and power in circuits using Ohm's Law, Kirchhoff's Law, and Watt's Law.
2.1.9 Describe the purpose of grounding and common methods used for grounding.
2.1.10 Evaluate frequency and phase.
2.1.11 Identify methods of varying capacitance.
2.1.12 Calculate true power, apparent power, reactive power, and power factor.
2.1.13 Determine impedance.
2.1.14 Compare peak (PK), root mean square (RMS), and average values.

Outcome: 2.2. Circuits:
I Can … Construct and analyze alternating current (AC) circuits and direct current (DC) circuits.

Competencies

2.2.1. Compare and contrast conductors and insulators.
2.2.2. Identify common types of transformers and list uses for each.
2.2.3. Explain step up/step down voltage methods.
2.2.4. Describe lamination and explain why laminations are used.
2.2.5. Identify types of capacitors and common usages for each.
2.2.6. Identify types of inductors and explain the purposes of different core materials.
2.2.7. Identify the function of inductors and capacitors in series and parallel circuits.
2.2.8. Explain the uses of series, parallel, and series-parallel circuits.
2.2.9. Construct and troubleshoot series, parallel, and series-parallel circuits.
2.2.10. Analyze wiring schematics and diagrams for accuracy and function.

Outcome: 2.3. Codes and Regulations:
I Can … Explain and apply the National Electrical Code (NEC) and other building codes.

Competencies
2.3.2. Explain the role of Underwriters Laboratory (UL), Canadian Standards Association (CSA), and Intertek Testing Service/Edison Testing Laboratory (ITS/ETL).

Outcome: 2.4. Electronic Components:
I Can … Describe electronic components and their functions and purpose.

Competencies
2.4.1. Identify resistor values from color codes or other marks.
2.4.2. Compare and contrast resistor compositions and their uses.
2.4.3. Identify symbols for electronic components.
2.4.4. Compare and contrast negative positive negative (NPN) and positive negative positive (PNP) transistors.
2.4.5. Identify types of transistors and explain their uses (i.e., Darlington pairs, unijunction transistors, Gunn diodes, field effect transistors [FETs] and metal-oxide semiconductor field-effect transistor [MOSFETs], N- and P- channel junction field effect transistors [JFETs]).
2.4.6. Compare and contrast the purpose and function of thyristors (diacs, triacs, varisters, and thermistors).
2.4.7. Describe the purpose and operation of zener diodes.
2.4.8. Describe the purpose and operation of common optical devices (e.g., light emitting diodes [LEDs], liquid crystal displays [LCDs]).
2.4.9. Describe the purpose and operation of photovoltaic cells.
2.4.10. Describe the purpose, composition, and operation of photo resistors, photodiodes, and phototransistors.
2.4.11. Define surface mount components.
2.4.12. Describe the purpose and operation of audio amplifiers and their frequency response.
2.4.13. Explain the purpose and operation of common emitter (CE) amplifiers, common base (CB) amplifiers, and common collector (CC) or emitter follower amplifiers.

Outcome: 2.5. Electronic Soldering Connections:
I Can … Connect individual components into an electrical unit.

Competencies
2.5.1. Define the purpose of a connection and the differences between a good and bad connection.
2.5.2. Select types of solder.
2.5.3. Describe methods for soldering and desoldering and the purpose for each method.
2.5.4. Protect circuit boards from electrostatic discharge (ESD).
2.5.5. Solder and desolder components.
2.5.6. Combine components per wiring prints, schematics, and block diagrams.

Outcome: 2.6. Digital Electronics:
I Can … Create circuits to perform tasks and operations.

Competencies
2.6.1. Determine output frequency of circuits.
2.6.2. Describe the purpose and use of logic gates (e.g., discrete and medium scale integration [MSI] gates, latches, flip-flops).
2.6.3. Design a paradigm for combinational logic circuits (i.e., encoders, decoders, multiplexers, demultiplexers, adders, subtractors, ALUs). *(Updated 28 AUG 2014)*
2.6.4. Design a specific MSI gate application.
2.6.5. Describe the purpose and operation of programmable logic devices (PLDs) and complex programmable logic devices (CPLDs).
2.6.6. Describe the purpose and use of asynchronous and synchronous counters.
2.6.7. Determine fan-out and propagation delays.
2.6.8. Explain the purpose and use of a digital bus.
2.6.9. Explain the purpose and use of pulsers and logic probes.
2.6.10. Identify the numbering systems, codes, arithmetic operations, Boolean operations, and simplification methods used in digital electronics.
2.6.11. Describe the purpose and use of digital-to-analog and analog-to-digital circuits.
2.6.12. Design a schematic for a digital circuit.
2.6.13. Utilize counters and shift registers in a circuit. *(Updated 28 AUG 2014)*
2.6.14. Utilize memory in a control system
2.6.15. Construct a digital circuit based on the schematic using solder and solderless techniques.
2.6.16. Test circuit function.
2.6.17. Use schematics and test points to locate subsystem, component, and wiring failures in electronics products.
2.6.18. Use the Boolean Algebra laws and DeMorgan's Theorem in the simplification of logic circuits. *(Updated 28 AUG 2014)*

Outcome: 2.8 Power Supplies:
I Can … Provide power to electrical circuits.

Competencies
2.8.1 Identify the differences between transformer-powered supplies and line-connected supplies.
2.8.2 Select a battery based on composition, environment, and circuit characteristics.
2.8.3 Select and install filters.
2.8.4 Construct and install regulated power supplies.
2.8.5 Select and install fuses and circuit breakers.
2.8.6 Select and construct half-wave, full wave, and bridge rectifiers.
2.8.7 Select and install power conditioning, isolation transformers, surge suppressors, and uninterruptible power supplies.

Strand 5. Pre-Engineering: Design and Development
Learners apply principles of design and development related to the design process, sketching and visualization, modeling, drafting, materials and production and process design.

** *This strand is covered extensively under the Capstone course and competencies are revised and retaught if needed.*

Outcome: 5.2. Sketching and Visualization:
I Can … Conceptualize and sketch design projects and components.

Competencies
5.2.1. Compare and contrast technical sketching and drawing.
5.2.2. Sketch possible solutions to an existing design problem.
5.2.3. Use tolerancing techniques when dimensioning.
5.2.4. Apply annotations on sketches and drawings.
5.2.5. Create sketches using integration sketching techniques and styles.

Scope and Sequence
Engineering Capstone
175009

Course Description:
The capstone course provides opportunities for students to apply knowledge, attitudes and skills that were learned in Engineering program in a more comprehensive and authentic way. Capstones often include project/problem based learning opportunities that occur both in and away from school. Under supervision of the school and through community partnerships, students may combine classroom learning with work experience. This course can be delivered through a variety of delivery methods including cooperative education or apprenticeship.

"Senior project (capstone) incorporates employability skills, entrepreneurships skills as well as business ethics, finance awareness and electronic skills the students have gained throughout the two year program. The project involves group work, public speaking and presentational skills. The final working project will be presented to a panel of judges made up of members of the advisor board."

Scope and Sequence
Engineering Capstone
West-Shore Career Tech

Strand 1. **Business Operations/21st Century Skills**
Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field.

Outcome: **1.2. Leadership and Communications:**
I Can … Process, maintain, evaluate, and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competencies
1.2.1. Extract relevant, valid information from materials and cite sources of information.
1.2.2. Deliver formal and informal presentations.
1.2.3. Identify and use verbal, nonverbal, and active listening skills to communicate effectively.
1.2.4. Use negotiation and conflict-resolution skills to reach solutions.
1.2.5. Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.
1.2.6. Use proper grammar and expression in all aspects of communication.
1.2.7. Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.
1.2.8. Identify the strengths, weaknesses, and characteristics of leadership styles that influence internal and external workplace relationships.
1.2.9. Identify advantages and disadvantages involving digital and/or electronic communications (e.g., common content for large audience, control of tone, speed, cost, lack of non-verbal cues, potential for forwarding information, longevity).
1.2.10. Use interpersonal skills to provide group leadership, promote collaboration, and work in a team.
1.2.11. Write professional correspondence, documents, job applications, and résumés.
1.2.12. Use technical writing skills to complete forms and create reports.
1.2.13. Identify stakeholders and solicit their opinions.
1.2.14. Use motivational strategies to accomplish goals.

Outcome: 1.4. Knowledge Management and Information Technology:

I Can … Demonstrate current and emerging strategies and technologies used to collect, analyze, record, and share information in business operations.

Competencies

1.4.1. Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).
1.4.2. Select and use software applications to locate, record, analyze, and present information (e.g., word processing, electronic mail, spreadsheet, databases, presentation, Internet search engines).
1.4.3. Verify compliance with security rules, regulations, and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to industry pathway.
1.4.4. Use system hardware to support software applications.
1.4.5. Use information technology tools to maintain, secure, and monitor business records.
1.4.6. Use electronic database to access and create business and technical information.
1.4.7. Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).
1.4.8. Use electronic media to communicate and follow network etiquette guidelines.

Outcome: 1.5. Global Environment:

I Can … Evaluate how beliefs, values, attitudes, and behaviors influence organizational strategies and goals.

Competencies

1.5.3. Use cultural intelligence to interact with individuals from diverse cultural settings.
1.5.4. Recognize barriers in cross-cultural relationships and implement behavioral adjustments.
1.5.5. Recognize the ways in which bias and discrimination may influence productivity and profitability.
1.5.6. Analyze work tasks for understanding and interpretation from a different cultural perspective.
1.5.7. Use intercultural communication skills to exchange ideas and create meaning.
1.5.8. Identify how multicultural teaming and globalization can foster development of new and improved products and services and recognition of new opportunities.

Outcome: 1.6. Business Literacy:
I Can … Develop foundational skills and knowledge in entrepreneurship, financial literacy, and business operations.

Competencies
1.6.1. Identify business opportunities.
1.6.2. Assess the reality of becoming an entrepreneur, including advantages and disadvantages (e.g., risk vs. reward, reasons for success and failure).
1.6.3. Explain the importance of planning your business.
1.6.4. Identify types of businesses, ownership, and entities (i.e., individual proprietorships, partnerships, corporations, cooperatives, public, private, profit, not-for-profit).
1.6.5. Describe organizational structure, chain of command, the roles and responsibilities of the organizational departments, and interdepartmental interactions.
1.6.6. Identify the target market served by the organization, the niche that the organization fills, and outlook of the industry.
1.6.7. Identify the effect of supply and demand on products and services.
1.6.8. Identify the features and benefits that make an organization's product or service competitive.
1.6.10. Describe the impact of globalization on an enterprise or organization.
1.6.11. Describe how all business activities of an organization work within the parameters of a budget.

Strand 5. Pre-Engineering: Design and Development
Learners apply principles of design and development related to the design process, sketching and visualization, modeling, drafting, materials and production and process design.

Outcome 5.1 The Design Process Digital Electronics
I Can … Use the engineering design process and quality assurance principles to analyze and solve design problems.

Competencies
5.1.1. Describe the role of research, development, and experimentation in design problem solving.
5.1.2. Conduct an investigation to identify customer needs, constraints, and criteria.
5.1.3. Develop multiple solutions and select an approach.
5.1.4. Develop a design proposal and make a model/prototype.
5.1.5. Evaluate and redesign a prototype using collected data.
5.1.8. Maintain an engineering journal to document progress and capture ideas during the development phase.

Outcome: 5.2. Sketching and Visualization:
I Can … Conceptualize and sketch design projects and components.

Competencies
5.2.6. Compare and contrast technical sketching and drawing.
5.2.7. Sketch possible solutions to an existing design problem.
5.2.8. Use tolerancing techniques when dimensioning.
5.2.9. Apply annotations on sketches and drawings.
5.2.10. Create sketches using integration sketching techniques and styles.

Outcome 5.3. Computer-Aided Modeling
I Can … Create models to illustrate the design of projects and components.

5.3.1. Apply manufacturing processes (e.g., casting, molding, forming, separating, conditioning, assembling, finishing, rapid prototyping).
5.3.2. Evaluate a sketch and generate a model utilizing three-dimensional modeling software and techniques.
5.3.3. Compare and contrast conceptual, physical and mathematical design models used to check proper design.
5.3.4. Perform part manipulation during the creation of an assembly model.
5.3.5. Analyze assembly constraints to successfully construct a multipart object.
5.3.6. Utilize part libraries effectively during the assembly modeling process.
5.3.7. Employ subassemblies during the production of assemblies.
5.3.8. Verify drive constraints that simulate the motion of parts in assemblies.
5.3.9. Apply adaptive design concepts during the development of sketches, features, parts and assemblies.
5.3.12. Evaluate a model for design imperfections.

Outcome 5.6. Production and Process Design
I Can … Plan, set up, monitor, analyze and control integrated systems.

Competencies
5.6.4. Identify criteria and constraints and determine how those will affect the design of the production process.
5.6.5. Estimate time, tooling, product packaging and material costs.
5.6.6. Monitor performance against time, tool and material cost estimates.

SENIOR FINAL PROJECT PRESENTATIONS

Project Based Learning Activity

(90 Points)

"This assignment will be weighted in Progress Book to count twice as much as any other assignment this year"

Unit Objectives:

- Employ critical thinking and problem solving skills to gather information and build a final working prototype.
- Demonstrate technical skills and creativity in building a prototype.
- Demonstrate collaborative learning by your ability to work with a partner and recognize the importance of team work.
- Demonstrate time management skills by meeting all of the set deadlines.
- Demonstrate clerical skills and attention to details by presenting a written report about your product and the data collected. (The costs, pros, cons and suggestions to future students.)
- Demonstrate professional, marketable presentation skills by presenting a final oral (communication) before a panel of judges.

Scenario:

"You are a young entrepreneur and have been given the opportunity to show case your new product before a panel of wealthy investors. The product should be functional (serve a purpose) and practical (everyday people would have a use for it) at a reasonable cost. You are to build a working prototype and give an oral presentation, as well as provide a written report of your product."

Pacing Guide:

Step 1: Chose a partner. Names are to be submitted by (October xx) Points +1

Step 2: Product ideas submitted by (November xx) Points +1

Step 3: Product final ideas submitted together with component layouts & schematic diagrams to be submitted before (December xx) Points +1

Step 4: Parts list submitted together with predicted costs by (January xx) Points +1

Step 5: All parts/components to be brought to school. (February xx) Points +2

Step 6: Product to be in the final stages of assembly by (March xx) Points +1
Rough draft of write-up due by (March xx) Points +1

Step 7: Final product complete and working by (April xx) Points +1
Final write-up due by (April xx) Points +1

Step 8: Presentations before the panel (April xx) *Meeting all due dates = +10 points*

Hints & Suggestions:

For step 1: (Choosing a partner)

Don't just chose a friend. Look for strengths and weaknesses. Ask yourself, "What skills or resources can your partner bring to the project?" "How reliable are they?" Don't just chose.....Think first!

For step 2: (Product Ideas)

Brain storm ideas that meet the scenario set, a functional, practical project. ie: Something that could be used by many people. Guiding questions:

"Does the product meet the given criteria?"

" Are all the parts easily obtainable?"

" Are the costs involved manageable?"

“ Will we be able to successfully complete this project in the given time?"

For step 3: (Final ideas)

Your ideas may change as you and your partner wrestle with the guiding questions above. Once you have decided on a project that answers "yes" to all these questions, gather all the required paperwork (component layout, schematic diagram an track layout) and hand it to me. Your project is now locked in! Make a copy for yourself of all these papers as these will be required as part of your final write-up.

For step 4: (Parts list)

Print out a neatly tabulated required parts list, together with where you plan on purchasing the parts from and the associated costs. Again, make a copy for yourselves to be included in your final write-up.

For step 5: (Bring parts to school)

All your required parts to successfully complete this project are to be brought to school. Class time will be allocated to this project to allow you use of the workshop and the tools that you may not have access to at home.

Time to think about how you are going to house your final product, are you going to buy a readymade box, build a box or utilize the project lead the way class/students to custom make a box using the 3D printer.

Guiding questions: " What is the cost?"

" How long is it going to take?"

"What if I mess up the first one, how easily can I get a replacement?"

For step 6: (Final stages)

The projects should be coming down the home stretch. By now it should be looking like an electronics projects, with a majority of the components installed. What's important to remember at this stage is that the most time consuming part of a project and arguably the most difficult is if it does not work first time. Ensure you stick to your dead line dates and allow some time to fix any possible "oops" that may occur. Remember, good planning is the key to success in any project.

** Your write-up should be making steady progress by this stage. I would suggest keeping a folder with all the paper work you have required along the way (parts lists, schematics, costs etc) and also a journal dating your progress and 'things' you encountered along the way. This will help when you have to come back later and put it all together. Please ensure you read and pay careful attention to the section marked Project Write-Up.

For step 7: (Project complete)

The final product should be working. No-one is interested in something that does not work no matter how great the idea! It should be housed such that it looks like a final product, is eye catching and

professional. It should look well thought out and reflect the efforts that have gone into producing it. Completed write-up handed in .... Please see Project Write-Up.
For step 8: (Presentation Day)
Similar to the TV series '*The Shark Tank*' you will be presenting your product to a panel of professionals. You are expected to dress business professional. You will be graded on both your product and your presentation, including your delivery and your appearance. See the attached rubrics to get an idea of the grading.
I would suggest practicing your delivery/presentation so that you come across confident and professional. Remember things like, eye contact with your audience, the speed/pace of your delivery (too fast or too slow is not good), speak clearly and be prepared to answer questions on your product.
Hint: Using visual aids may help to make for a better eye catching, memorable presentation, however be careful to not overdo it and detract from the product. You have access to big screen projectors, lasers, smoke machines, flashing cubes, sound ... think outside the box!

PROJECT WRITE-UP:
This is a guide to help ensure a successful final write-up. This is only a guide so please use your creative spirit to go beyond.
Name of Product:
Name of Group members: (Lets call them the product designers)
Pictures - final product, step by step construction etc
Diagrams - Schematics, component list, component layout etc
Where did you get the parts from? Cost?
A step-by-step guide on how to build this product.
Suggestions, hints and tips, things to watch out for, troubles you encountered and how you overcame them.
The idea is that if your write-up was given to another student they would be able to reproduce your product.
Ensure you make use of color.
Be creative, take pride in your write-up and ensure it reflects your efforts.

GRADING RUBRICS:

Working Prototype	= 24 points
Oral Presentation	= 24 points
Written Report	= 24 points
Due Dates	= 10 points
Self Assessment	= 4 points
Evidence of collaborative learning	= 4 points

SENIOR FINAL PROJECT - SELF ASSESMENT
(+4 Points)

YOUR NAME: _____

PARTNERS NAME: _____

How much work did you put into this project?

_____

(Scale 1 - 5 ..... 1= Very little and 5 = As much as humanly possible.)

- Explain.

_____

_____

_____

- How much work did your partner put into this project?_____
  (Scale 1 - 5 ..... 1= Very little and 5 = As much as humanly possible.)
- Explain.

_____

_____

_____

- What did you learn through this project?

_____

_____

_____

- Was this Project Based Learning assignment meaningful?

_____

- Explain.

_____

- What did you not enjoy about this assignment?

- If you had the chance to redo this assignment, what would you do differently?

- Suggestions or comments for future students or teacher?

STUDENT ASSESSMENT POLICY

ELECTRONIC ENGINEERING

WEST SHORE CAREER AND TECHNICAL EDUCATION DISTRICT

The student shall perform competencies and competency and key indicators in a manner acceptable to the business community. The standards set for these competencies are recommended by the advisory committee members and employers in the business community and evaluated by the teacher following these guidelines. Competencies will be identified which must be mastered in order to receive credit for course.

In order to measure the progress of each student in the program and to measure the effectiveness of the total program, the following assessment procedures will be used:

- Unit / Post tests
- Teacher observation and assessment
- Self-assessments
- Class discussions
- Skill tests
- Project Development
- Daily Compliance grades
- Quarterly progress tests
- Lab performance
- Computer Simulated Evaluations

Measurement of learning will be an on-going activity with emphasis on laboratory activities and core standard improvement. Evaluation will be done through pre-assessment of student skills, frequent formative assessment, both visual and written, and summative assessment to determine mastery of competencies. The number of competencies mastered will be translated into appropriate grades consistent with the school's grading system and consistent with district and school policy.

Lakewood City School District's Grading Scale

Grade	Percent Range
A+	96.50 – 100
A	92.50 – 96.49
A-	89.50 – 92.49
B+	86.50 – 84.49
B	82.50 – 86.49
B-	79.50 – 82.49
C+	76.50 – 79.49
C	72.50 – 76.49
C-	69.50 – 72.49
D+	66.50 – 69.49
D	62.50 – 66.49
D-	59.50 – 62.49
F	0.00 – 59.49

The Electronic Engineering program will take the Ohio Career Technical Core Standard Assessments, which is a web-based exit exam, to attest to their abilities.
At the completion of the program, each student will receive a Career Passport and Certificate indicating competencies in which the student is proficient.