**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.

**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:** 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, resume 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:** 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 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 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:** 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 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]).

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:** 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:** 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:** 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.

**Outcome 1.9. Financial Management:** 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.

**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:** Describe the functions and purposes of electronic components.

**Competencies**

2.4.1. Identify resistor values from color codes or other marks.

2.4.2. Compare resistor compositions and their uses.

2.4.3. Identify symbols for electronic components.

2.4.4. Compare negative positive negative (NPN) and positive negative positive (PNP) bipolar junction transistors (BJT).

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 the purpose and function of thyristors (e.g. diacs, triacs, and varisters).

2.4.7. Describe the purpose and operation of zener diodes.

2.4.8. Describe the purpose and operation of optical interface 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 Connections:** Connect individual components into an electrical circuit.

**Competencies**

2.5.1. Define the purpose of a connection and the differences between a good and bad connection.

2.5.2. Describe methods of electrical connections and the purpose for each method.

2.5.3. Select type of electrical connection for electrical components.

2.5.4. Protect circuit boards from electrostatic discharge (ESD).

2.5.5. Use electrical connections to connect individual electronic units.

2.5.6. Combine components per wiring prints, schematics and block diagrams.

**Outcome 2.8. Power Supplies:** 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.

**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 5.4. Materials:** Select materials for design projects and components.

**Competencies**

5.4.1. Compare advantages of materials used in manufacturing based on physical properties.

5.4.4. Evaluate the types and magnitude of stresses and forces.

5.4.6. Select materials for a given application based on specified criteria (e.g. cost, availability, manufacturability).

**Strand 6. Precision and Advanced Machining**

Learners apply principles of precision machining to measuring work pieces, drawing interpretation, inspection, bench work and layout, power saws, drilling machines, lathes and turning machines, milling machines and grinding machines.

**Outcome 6.1. Measurement and Interpretation:** Interpret drawings and documentation and perform measurements.

**Competencies**

6.1.3. Identify measuring systems and convert between systems.

6.1.4. Identify information and symbols typically provided in drawings and specifications.

**Strand 7. Industrial Maintenance and Safety**

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:** 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.

7.1.6. 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:** 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.