

Engineering and Science Technologies Career Field

Digital Electronics

Subject Code: 175007

Outcome & Competency Descriptions

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.

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.

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- 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: 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 [EEOC]).
- 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.

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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, 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: 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

- 1.6.1. 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.

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- 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.

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
- 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.
- 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 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 Electrical and Electronic Theory: Explain electrical and electronic principles and theory.

Competencies

- 2.1.1. Describe the structure of atoms and their relationship to electricity.
- 2.1.2. Compare electrical and electromagnetic effect.

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- 2.1.3. Explain methods of producing electrical current.
- 2.1.4. Explain how batteries store and disperse energy.
- 2.1.5. Compare 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.

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

Competencies

- 2.2.1. Compare conductors and insulators.
- 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: 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 2.4. Electronic Components: 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 resistor compositions and their uses.
- 2.4.3. Identify symbols for electronic components.

Outcome 2.5. Electrical 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.

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

Competencies

- 2.6.1. Convert number systems (e.g. binary coded decimal (BCD) to decimal, and decimal to BCD).
- 2.6.2. Determine output frequency of circuits.
- 2.6.3. Describe the purpose and use of logic gates (e.g. discrete and medium scale integration [MSI] gates, latches, flip-flops).
- 2.6.4. Design a paradigm for combinational logic circuits
- 2.6.5. Design a specific MSI gate application.
- 2.6.6. Describe the purpose and operation of programmable logic devices (PLDs) and complex programmable logic devices (CPLDs).
- 2.6.7. Describe the purpose and use of asynchronous and synchronous counters.
- 2.6.8. Determine fan-out and propagation delays.
- 2.6.9. Explain the purpose and use of a digital bus.
- 2.6.10. Explain the purpose and use of pulsers and logic probes.
- 2.6.11. Identify the numbering systems, codes, arithmetic operations, Boolean operations, and simplification methods used in digital electronics.
- 2.6.12. Describe the purpose and use of digital-to-analog and analog-to-digital circuits.
- 2.6.13. Design a schematic for a digital circuit.
- 2.6.14. Utilize a counter in a circuit.
- 2.6.15. Utilize memory in a control system.
- 2.6.16. Construct a digital circuit based on the schematic using solder and solderless techniques.
- 2.6.17. Test circuit function.
- 2.6.18. Use schematics and test points to locate subsystem, component, and wiring failures in electronics products.

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 5.2. Sketching, Drawing and Visualization: Conceptualize, sketch and draw design projects and components.

Competencies

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