Burlington County Institute of Technology

Westampton Campus

Career and Technical Programs

Career Cluster: *Manufacturing*
Program Name: *Electrical, Electronic, and Communications Engineering Technology*
Program Title: *Electronics Technology*
CIP Code: *150303*

Board Approval Date: August, 2025

Program of Study

- ➔ Grade 9
  - Introduction to Electronics
  - Circuits I
- ➔ Grade 10
  - Circuits II
  - Clinical circuits I
  - Semiconductors Electronics
- ➔ Grade 11
  - Clinical Circuits II
  - Digital I Electronics
  - Digital II Electronics
- ➔ Grade 12
  - Microprocessor Applications I
  - Microprocessor Applications II
  - Electronics Independent Projects I
  - Electronics Independent Projects II
  - Cooperative Education (Optional)

➔ Program Descriptor

- The Electronics Technology program is designed to teach and enlighten the student with a holistic approach. Students will learn Electronics in a variety of ways utilizing team based concepts with peer inspections, cross functional training, data collection and documentation with an emphasis on total quality management. Students will learn and gain an array of experiences from a complement of various project based projects to give balance and experience for the many different aspects of electronics. In addition, students will learn leadership skills as shop forman, public speaking, basic first aid techniques, basic financial planning, conflict management skills, project planning and organizational skills essential in today's industry.

➔ Program Outcome

- Graduates of the Electronics Technology program will possess an array of competitive and desirable skills that include a comprehensive understanding of Electronics and team based concepts. Students will have gained experience and exposure through project based assignments that include Soldering/Rework: single sided, double sided and surface mount boards, project design, tool usage, test equipment, calibration, schematic interpretation,wiring, prototyping, calibration, troubleshooting, programming and mechanical assembly. Students entering the workforce will have the qualifications as an entry level technician. Students during their senior year will take the International Society of certified Electronics technician exam (ISCET) laying the foundation to acquire future certifications. Students progressing onward educationally have the building blocks to move towards field engineering as well.

➔ Work Based Learning Opportunities

- Simulated Workplace Environment: Students constructing project based assignments, for example: Level 3 is currently constructing an Analog/Digital trainer XK-700K. The project has a variety of features such as: a sign wave generator, prototype features, multiple power supplies, logic capabilities encased in

a suitcase. The Project is broken down into sections: inventory, construction and testing. Students upon completion of a section must receive an inspection from his/her peers before going to the instructor. Students must perform a variety of tasks such as start dates, signatures, test results and footnotes on the assembly manual. Students must then fill out a lab report on work done then verbally explain operation, function and application on the section completed to the instructor before moving forward.

- Non-Hazardous Cooperative Education: Students will be placed in a variety of workplace settings such as Radwell and OPEC to perform entry-level electronics technology tasks.

➔ Industry Valued Credentials

- Certified Electronics Technician (ISCET)
- OSHA 10

Course Descriptions

1. Grade 9
    a. *Introduction to Electronics:* This course explores the field of Electronics and its many opportunities. This course is designed for students with little or no experience. The curriculum includes safety, scientific notation, basic electrical units, tools identification and use, component identification, symbols and function, ohm's law, sources of electricity, transistors, integrated circuits,test equipment use and operation. Theory and circuit analysis is reinforced with a variety of lab experiments, trainers, kits and computer simulation utilizing the TinkerCad program.
    b. *Circuits I:* This course builds in lessons learned in introduction to electronics by combining those individual aspects into circuit construction. Theory covers passive devices such as: scientific aspects of electricity, resistors , capacitors, inductors and their interaction with AC/DC voltage/ current as well as

supposition theory and network theorems. Circuit analysis is delivered in various forms via calculations, prototyping, and TinkerCad using trainers, kits and project based assignments. Students will utilize an array of test equipment to view,measure and troubleshoot then present their findings and provide applications used outside the classroom.

2. Grade 10
    a. *Circuits II:* This course explores the applications of AC/DC theory and applications and introduces integrated circuits exploring non-inverting and inverting signals, phasor theory, solid state amplifiers, filters, power supplies, RLC circuits, bandwidth and oscillators. Students will learn theory through discussions, circuit analysis, kits and project based assignments for example the AM-550K AM radio kit. Students will inventory, boardstuff, solder and calibrate the various sections, then present findings and documentation to the instructor for approval.
    b. *Clinical circuits I:* This course utilizes a variety of methods to reinforce electronic AC/DC theory through project based assignments, trainers, labs and kits to promote project design and schematic interpretation. Students will utilize test equipment and perform circuit analysis, soldering/rework, mechanical assembly and troubleshooting. All project based assignments will be under a structured environment utilizing manufacturing principles requiring the student to get peer inspections on component installation and soldering to maintain cross functional learning and promote total quality management.
    c. *Semiconductor Electronics:* Students will experience the purpose and application of various types of semiconductors such as diodes, bipolar transistors, common collector/emitter and field effect transistors. Students will learn testing, measuring and troubleshooting procedures to determine component and circuit integrity used in various rectifiers, amplifiers and power supplies. Subject matter will be delivered by means of trainers, kits and project based assignments.
3. Grade 11
    a. *Clinical circuits II AC/DC*: Students will combine lessons learned with introduction to electronics, circuits 1 & 2 and semiconductor principles learned in previous modules. Students will be responsible to inventory, construct, perform circuit analysis, interpret findings, troubleshoot complex circuits utilizing test equipment and their experience. Project based assignments may include such projects as Digital multimeters, Analog/digital trainers, logic probes , robotic arm and all terrain robot.

b. *Digital Electronics I:* This course covers the theory and application of digital logic circuits. Digital systems covered include, a digital introduction, various number systems, logic gates, gate and logic circuit operation, symbols and truth tables, along with operation of combinational and sequential logic gates. A discussion about the basic operating principles of multiplexers, demultiplexers, flip flops, wiring and testing thru use with a logic probe.
c. *Digital Electronics II:* This course covers theory and design logic circuits, integrating logic operations through the use of Boolean logic and karnaugh mapping. Students will construct a variety of challenging digital lab circuits from digital lab kits designed to complement theory with hands-on applications to reinforce and explain logic circuits such as clock circuits multiplexing, demultiplexing, flip flops, counters and shift registers. Students will troubleshoot utilizing test equipment and give an oral presentation on circuit operation and applications outside the class.

4. Grade 12
   a. *Microprocessor applications I and II*: These courses deal as an extension of Digital circuits 2 learning concepts in programming and the interfacing of microprocessors/microcontrollers demonstrated by a variety of application examples. It covers the architecture of modern processors and the many I/O peripherals now commonly found on-board the device. Studies of computer I/O and interrupt techniques as applied to analog-to-digital, digital-to-analog, timers, parallel and serial interfaces are included. Laboratory activities provide the student with experience in developing the hardware and software required to incorporate microprocessors into systems that solve real-world interfacing problems such as Arduino construction, programming and modifications .
   b. *Electronics independant projects I and II:* This experience allows students the ability to prepare them to enter the workforce and college by allowing the student more independent study. Students will demonstrate their skills and proficiencies utilizing lessons learned through a series of project based assignments. Students will also have an opportunity to further diversify from a variety of trainers such as: fire control system, residential electricity and motor controls.
   c. *Cooperative Education*

Curriculum Maps

Course: Safety	Unit: OSHA 10	Length: 1 Week

Standards

- 9.3.12.AG-FD.1 Develop and implement procedures to ensure safety, sanitation and quality in food product and processing facilities.
- 9.3.12.AC-CST.5 Apply practices and procedures required to maintain jobsite safety.
- 9.3.12.AR.2 Analyze the importance of health, safety and environmental management systems, policies and procedures common in arts, audio/video technology and communications activities and facilities.
- 9.3.12.ED.4 Evaluate and manage risks to safety, health and the environment in education and training settings.
- 9.3.HT-RFB.2 Demonstrate safety and sanitation procedures in food and beverage service facilities.
- 9.3.HU-ED.5 Evaluate safety and sanitation procedures associated with the early childhood education environment to assure compliance and prevent potential hazards.
- 9.3.LW.4 Conduct law, public safety, corrections and security work tasks in accordance with employee and employer rights, obligations and responsibilities, including occupational safety and health requirements.
- 9.3.LW-ENF.8 Explain the appropriate techniques for managing crisis situations in order to maintain public safety.
- 9.3.MN.3 Comply with federal, state and local regulations to ensure worker safety and health and environmental work practices.
- 9.3.MN-HSE.3 Demonstrates a safety inspection process to assure a healthy and safe manufacturing environment.

- 9.3.MN-HSE.5 Evaluate continuous improvement protocols and techniques in health, safety and/or environmental practices.
- 9.3.12.TD.5 Describe transportation, distribution and logistics employee rights and responsibilities and employers' obligations concerning occupational safety and health.
- 9.3.12.TD-HSE.1 Describe the health, safety and environmental rules and regulations in transportation, distribution and logistics workplaces.
- 9.3.12.TD-OPS.3 Comply with policies, laws and regulations in order to maintain safety, security and health and mitigate the economic and environmental risk of transportation operations.

Essential Question(s)

- Why is it important to practice safety?
- What do safe practices look like in my industry?
- How can I keep myself and others safe?

Content

- Walking working surfaces
- Emergency action plans
- Fire protection
- Electrocution hazards
- Personal protective equipment
- Hazard communication
- Materials handling, storage, use and disposal.

Skills

- Explain why OSHA is important to workers.
- Explain workers rights under OSHA
- Discuss employer responsibilities under OSHA.
- Discuss the use of OSHA standards.

- Explain how OSHA inspections are conducted.
- Utilize helpful worker safety and health resources.
- Identify hazards in the workplace associated with walking and working surfaces.
- Identify best practices for eliminating or controlling hazards associated with walking and working surfaces in the workplace.
- Recognize employer requirements to protect workers from walking and working surface hazards.
- Recognize benefits of an Emergency Action Plan.
- Identify elements of the Fire Protection Plan.
- Identify conditions under which evacuation actions may be necessary in an emergency situation.
- Identify conditions under which shelter-in-place may be necessary in an emergency situation.
- Identify characteristics of an effective emergency escape route.
- Recognize the five types of fire extinguishers, including the types of fires they can extinguish.
- Review requirements for proper maintenance of portable fire extinguishers.
- Identify major electrical hazards.
- Describe types of electrical hazards.
- Describe electrical protection methods.
- Recognize employer requirements to protect workers from electrical hazards.
- Recall employer responsibilities toward affected employees regarding PPE.
- Identify when face and head protection should be used.
- Recall which types of hand and foot protection should be used in a specific situation.
- Recognize the differences between respirator types.
- Identify the differences between full-body protection levels.
- Identify the employer's responsibilities under the HCS, including training requirements.
- Identify components of a Hazard Communication program.
- Describe requirements of the different types of Hazard Communication labels.
- Locate pertinent information about chemicals on labels, including other forms of hazard communication, to ensure "right to understanding" provisions of GHS requirements.
- Identify types of material handling equipment.
- Describe hazards associated with material handling activities (e.g., storage, use, and disposal).

- Identify methods to prevent hazards associated with material handling equipment.
- Recognize employer requirements to protect workers from material handling hazards
- Identify the main causes of machinery accidents.
- Recognize basic machinery parts that expose workers to hazards.
- Recognize workplace situations involving machinery that requires guarding.
- Identify the requirements for safeguards.
- Identify types of machine guards including types of devices used to safeguard machines.
- Identify strategies to control chemical hazards.
- Identify strategies to control biological hazards.
- Identify strategies to control physical hazards.
- Identify strategies to control ergonomic hazards.
- Identify OSHA requirements pertaining to bloodborne pathogens.
- List the potential routes of exposure from bloodborne pathogens.
- Identify the risks associated with Human Immunodeficiency Virus (HIV), Hepatitis B, and Hepatitis C Virus.
- Identify methods of preventing transmission of bloodborne pathogens & managing occupational exposures.
- Restate methods of the safe disposal of sharps.
- Recount steps which should be taken in the event of an exposure to a potential bloodborne pathogen.
- Recognize risk factors associated with work-related musculoskeletal disorders (MSD)s.
- Identify good posture.
- Describe safe lifting techniques.
- Identify ergonomic control methods for eliminating/reducing work-related MSDs.
- Identify the number one cause of death for U.S. teens.
- List eight risk factors for young drivers.
- Identify the biggest risk factor for young drivers.
- Define distracted driving.
- Provide examples and/or causes of distracted driving.
- Identify the biggest risk factor for distracted driving
- Discuss the risk of having other young passengers in the car.
- List some actions employers should take to keep employees safe while driving.

- List some actions employees can take to safely drive on the job.
- Define the term violence.
- Recall who is at risk for encountering workplace violence.
- Describe workplace violence prevention strategies.
- Identify how to StartSafe and StaySafe to prevent or lessen workplace violence.
- Recognize the costs of workplace accidents.
- Recognize the benefits of implementing an effective safety and health program.
- Describe the elements of an effective safety and health program.
- Identify three methods to prevent workplace hazards.

Assessments

- OSHA 10 Assessment and Certificate

Course: CTE	Unit: Career Awareness	Length: Woven Throughout

Standards

- 9.2.12.CAP.1: Analyze unemployment rates for workers with different levels of education and how the economic, social, and political conditions of a time period are affected by a recession.
- 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.

- 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans. •
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.2.12.CAP.7: Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.
- 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
- 9.2.12.CAP.9: Locate information on working papers, what is required to obtain them, and who must sign them.
- 9.2.12.CAP.10: Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans)
- 9.2.12.CAP.11: Demonstrate an understanding of Free Application for Federal Student Aid (FAFSA) requirements to apply for postsecondary education
- 9.2.12.CAP.12: Explain how compulsory government programs (e.g., Social Security, Medicare) provide insurance against some loss of income and benefits to eligible recipients.
- 9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.
- 9.2.12.CAP.14: Analyze and critique various sources of income and available resources (e.g., financial assets, property, and transfer payments) and how they may substitute for earned income
- 9.2.12.CAP.15: Demonstrate how exemptions, deductions, and deferred income (e.g., retirement or medical) can reduce taxable income.
- 9.2.12.CAP.16: Explain why taxes are withheld from income and the relationship of federal, state, and local taxes (e.g., property, income, excise, and sales) and how the money collected is used by local, county, state, and federal governments. •
- 9.2.12.CAP.17: Analyze the impact of the collective bargaining process on benefits, income, and fair labor practice. •
- 9.2.12.CAP.18: Differentiate between taxable and nontaxable income from various forms of employment (e.g., cash business, tips, tax filing and withholding). •

- 9.2.12.CAP.19: Explain the purpose of payroll deductions and why fees for various benefits (e.g., medical benefits) are taken out of pay, including the cost of employee benefits to employers and self-employment income.
- 9.2.12.CAP.20: Analyze a Federal and State Income Tax Return
- 9.2.12.CAP.21: Explain low-cost and low-risk ways to start a business.
- 9.2.12.CAP.22: Compare risk and reward potential and use the comparison to decide whether starting a business is feasible.
- 9.2.12.CAP.23: Identify different ways to obtain capital for starting a business

Essential Question(s)

- How does one prepare for a career?
- How does one improve marketability?
- Why is career planning important?
- What are the risks in starting a business?

Content

- There are strategies to improve one's professional value and marketability.
- Career planning requires purposeful planning based on research, self-knowledge, and informed choices.
- An individual's income and benefit needs and financial plan can change over time.
- Securing an income involve an understanding of the costs and time in preparing for a career field, interview and negotiation skills, job searches, resume development, prior experience, and vesting and retirement plans
- Understanding income involves an analysis of payroll taxes, deductions and earned benefits.
- There are ways to assess a business's feasibility and risk and to align it with an individual's financial goals

Skills

- Act as a responsible and contributing community member and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.

- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence.

Assessments

- Career Research Project
- Resume/Cover Letter

Course: Introduction to Electronics — Length: Semester

Standards

- 9.3.MN.1 Evaluate the nature and scope of the Manufacturing Career Cluster and the role of
- manufacturing in society and in the economy.
- 9.3.MN.2 Analyze and summarize how manufacturing businesses improve performance.
- 9.3.MN.3 Comply with federal, state and local regulations to ensure worker safety and health and
- environmental work practices.
- 9.3.MN.4 Describe career opportunities and means to achieve those opportunities in each of the
- Manufacturing Career Pathways.
- 9.3.MN.5 Describe government policies and industry standards that apply to manufacturing.
- 9.3.MN.6 Demonstrate workplace knowledge and skills common to manufacturing.

Essential Question(s)

- What safety measures should be taken when working with electronic components, and how do these practices contribute to a secure working environment?
- How does Ohm's Law guide the relationships between voltage, current, and resistance in electronic circuits, and how can it be applied to solve real-world problems?
- What are the fundamental differences between various electronic components, and how do they contribute to the functionality of electronic circuits?
- How do semiconductor devices such as transistors and integrated circuits function, and what are their essential roles in modern electronic systems?
- In what ways can TinkerCad and other simulation tools be effectively utilized for designing, testing, and analyzing electronic circuits, and how do these virtual experiments translate to real-world applications?

Content

- Safety in Electronics:
  - Importance of safety in handling electronic components and equipment.
  - Understanding and following safety protocols in electronic laboratories.
- Basic Electrical Concepts:
  - Introduction to scientific notation and its application in electronics.
  - Understanding basic electrical units (volts, amps, ohms) and their relationships.
- Tools Identification and Use:
  - Identification and proper usage of common tools used in electronics.
- Electronic Components:
  - Identification of electronic components, their symbols, and functions.
- Ohm's Law:
  - Comprehensive understanding and application of Ohm's Law in electronic circuits.
- Sources of Electricity:
  - Exploration of various sources of electricity used in electronics.
- Semiconductor Devices:

    - Introduction to transistors and integrated circuits.
- Test Equipment Operation:
    - Proper use and operation of test equipment in electronics laboratories.
- Hands-on Experiments:
    - Conducting lab experiments, utilizing trainers, kits, and computer simulations with TinkerCad.

Skills

- Demonstrate Safety Practices:
    - Follow and implement safety protocols when working with electronic components and equipment.
    - Use protective gear and adhere to safety guidelines in electronic laboratories.
- Apply Basic Electrical Concepts:
    - Utilize scientific notation for calculations in electronic contexts.
    - Apply the principles of volts, amps, and ohms in solving basic electrical problems.
- Utilize Electronic Tools:
    - Identify and effectively use common tools employed in electronics.
    - Demonstrate proficiency in handling tools for electronic assembly and testing.
- Identify and Understand Electronic Components:
    - Recognize and name various electronic components, understanding their symbols and functions.
    - Differentiate between components and describe their roles in electronic circuits.
- Apply Ohm's Law:
    - Solve practical problems involving Ohm's Law, calculating voltage, current, and resistance in electronic circuits.
    - Apply Ohm's Law to analyze and design simple electronic circuits.
- Explore Sources of Electricity:
    - Identify and understand different sources of electricity commonly used in electronic applications.
    - Analyze and compare the characteristics of various power sources.
- Understand Semiconductor Devices:
    - Explain the fundamental principles of transistors and integrated circuits.
    - Analyze the functions and applications of semiconductor devices in electronic systems.

- Operate Test Equipment:
  - Demonstrate proficiency in operating electronic test equipment for measurement and troubleshooting.
  - Interpret measurement results and make informed decisions based on test data.
- Conduct Hands-on Experiments:
  - Successfully perform laboratory experiments using electronic trainers, kits, and computer simulations.
  - Apply theoretical knowledge to practical scenarios, reinforcing understanding through hands-on activities.
- Apply Electronic Concepts in TinkerCad:
  - Utilize TinkerCad for computer simulations and virtual experiments.
  - Design and analyze electronic circuits using the TinkerCad platform.

Assessments

- Circuit Design and Analysis Project:
  - Task: Students will be given a project where they need to design and analyze a circuit using the knowledge gained in the course. This could involve creating a circuit on TinkerCad or using physical components.
    - Assessment Criteria: Evaluation will be based on the accuracy of the circuit design, application of Ohm's Law, appropriate use of electronic components, and the ability to troubleshoot and explain the circuit's functionality.
- Lab Practical Exam:
  - Task: A hands-on practical exam in the lab where students need to identify and use electronic tools, measure electrical quantities, and troubleshoot simple circuits.
    - Assessment Criteria: Assessment will focus on the students' ability to safely and accurately use tools, apply theoretical knowledge to practical scenarios, and troubleshoot and rectify issues in a timely manner.

Course: Circuits I	Length: Semester

Standards

- 9.3.MN-HSE.1 Demonstrate the safe use of manufacturing equipment.
- 9.3.MN-HSE.2 Develop safety plans for production processes that meet health, safety and environmental
- standards.
- 9.3.MN-HSE.3 Demonstrate a safety inspection process to assure a healthy and safe manufacturing
- environment.
- 9.3.MN-HSE.4 Evaluate a system of health, safety and/or environmental programs, projects, policies or
- procedures to determine compliance.
- 9.3.MN-HSE.5 Evaluate continuous improvement protocols and techniques in health, safety and/or
- environmental practices.
- 9.3.MN-HSE.6 Conduct job safety and health analysis for manufacturing jobs, equipment and processes.
- 9.3.MN-HSE.7 Develop the components of a training program based on environmental health and safety
- regulations.

Essential Question(s)

- What are the fundamental scientific principles that govern electricity, and how do they apply to circuits?
- How do passive devices such as resistors, capacitors, and inductors influence the behavior of AC and DC circuits, and how can their characteristics be analyzed?
- What is the significance of supposition theory and network theorems in simplifying and understanding complex electrical circuits?
- How do you effectively construct and prototype circuits using a variety of components, and what considerations are essential for successful circuit implementation?
- In what ways can circuit analysis techniques, including calculations, simulations, and tools like TinkerCad, be employed to analyze, troubleshoot, and optimize electrical circuits?

Content

- Scientific Aspects of Electricity:
  - Understand the fundamental principles of electricity, including voltage, current, and resistance.
  - Explore the properties and behavior of electrical circuits.
- Resistors, Capacitors, and Inductors:
  - Learn the characteristics and functions of resistors, capacitors, and inductors.
  - Understand how these passive devices interact with AC and DC voltage/current.
- Supposition Theory and Network Theorems:
  - Delve into supposition theory, understanding the theoretical underpinnings of circuit analysis.
  - Explore network theorems to simplify and analyze complex electrical circuits.
- Circuit Construction and Prototyping:
  - Gain hands-on experience in constructing circuits using various components.
  - Learn prototyping techniques for circuit design and implementation.
- Circuit Analysis Techniques:
  - Develop skills in analyzing circuits through calculations and practical applications.
  - Use TinkerCad to simulate and analyze circuits in a virtual environment.
- Test Equipment Utilization:
  - Familiarize yourself with a range of test equipment, including multimeters, oscilloscopes, and signal generators.
  - Learn how to use test equipment to measure, view, and troubleshoot circuits.
- Project-Based Assignments:
  - Engage in project-based assignments that require applying circuit theory to real-world scenarios.
  - Present findings and demonstrate practical applications of circuit construction.
- Applications Outside the Classroom:
  - Explore and discuss real-world applications of circuit theory.
  - Understand how circuit principles are utilized in various technological and industrial contexts.

Skills

- Demonstrate Understanding of Scientific Aspects:
  - Explain the fundamental principles of electricity, including voltage, current, and resistance.
  - Apply scientific concepts to analyze electrical circuits.
- Apply Knowledge of Passive Devices:
  - Identify and characterize resistors, capacitors, and inductors.
  - Analyze the role of these passive devices in AC and DC circuits.
- Employ Supposition Theory and Network Theorems:
  - Apply supposition theory to theoretical circuit analysis.
  - Utilize network theorems to simplify and analyze complex circuits.
- Master Circuit Construction and Prototyping:
  - Construct circuits using a variety of components.
  - Demonstrate proficiency in circuit prototyping techniques.
- Utilize Circuit Analysis Techniques:
  - Analyze circuits through calculations and simulations.
  - Use TinkerCad to simulate and analyze virtual circuits.
- Operate Test Equipment Effectively:
  - Operate and interpret measurements from multimeters, oscilloscopes, and signal generators.
  - Troubleshoot circuits using appropriate test equipment.
- Complete Project-Based Assignments:
  - Successfully execute project-based assignments that apply circuit theory to practical scenarios.
  - Present findings effectively and demonstrate the application of circuit construction.
- Apply Circuit Theory in Real-World Applications:
  - Relate circuit principles to real-world applications.
  - Identify and explain how circuit theory is employed in various technological and industrial contexts.

Assessments

- Circuit Construction Project:
  - Students will design and construct a complex electrical circuit, incorporating passive devices, applying supposition theory, and utilizing network theorems. The assessment will evaluate their ability to apply

theoretical knowledge to practical circuitry, troubleshoot issues, and present a comprehensive analysis of their circuit.

- Circuit Analysis Exam:
  - A comprehensive exam covering theoretical concepts, calculations, and circuit analysis. Students will be required to solve problems related to the behavior of passive devices, apply network theorems, and demonstrate proficiency in using test equipment. This assessment aims to evaluate their understanding of fundamental principles and their ability to apply them to real-world scenarios.

Course: Circuits II | Length: Semester

Standards

- 9.3.MN-PPD.1 Produce quality products that meet manufacturing standards and exceed customer satisfaction.
- 9.3.MN-PPD.2 Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
- 9.3.MN-PPD.3 Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
- 9.3.MN-PPD.4 Implement continuous improvement processes in order to maintain quality within manufacturing production.
- 9.3.MN-PPD.5 Develop procedures to create products that meet customer needs.

Essential Question(s)

- How does AC/DC theory contribute to the understanding of electronic circuits, and what are the key differences in their applications?

- What are the essential characteristics and applications of integrated circuits, particularly in the context of non-inverting and inverting signals?
- How does phasor theory enhance the analysis of AC circuits, and what role does it play in handling phase relationships?
- In what ways do solid-state amplifiers contribute to electronic systems, and how can they be effectively designed and implemented?
- What considerations are crucial when configuring filters and power supplies, and how do these components impact the performance of electronic circuits?

Content

- AC/DC Theory and Applications:
  - Understanding the principles and applications of both AC and DC circuits, including voltage, current, and impedance characteristics.
- Integrated Circuits:
  - Exploring the functionality of integrated circuits, with a focus on non-inverting and inverting signals. Understanding the role of integrated circuits in electronic systems.
- Phasor Theory:
  - Learning the concept of phasors in AC circuits and their application in analyzing and solving electrical problems.
- Solid State Amplifiers:
  - Studying the theory and practical aspects of solid-state amplifiers, including their design, characteristics, and applications.
- Filters and Power Supplies:
  - Understanding the principles behind filters and power supplies, their configurations, and their role in electronic circuits.
- RLC Circuits:
  - Exploring circuits containing resistors, inductors, and capacitors (RLC circuits) and analyzing their behavior in different scenarios.
- Bandwidth:

        - Understanding the concept of bandwidth in electronic circuits and its importance in signal processing.
    - Oscillators:
        - Exploring the theory and applications of oscillators, including different types and their role in generating periodic waveforms.
    - AM Radio Kit Project:
        - Hands-on experience with an AM radio kit (e.g., AM-550K), involving inventorying, board stuffing, soldering, calibration, and documentation.
    - Project-Based Assignments:
        - Engaging in various project-based assignments to apply theoretical knowledge to practical circuitry, fostering hands-on skills and problem-solving abilities.

Skills

- Demonstrate Understanding of AC/DC Theory:
    - Develop a comprehensive understanding of AC and DC circuits, including voltage, current, and impedance characteristics.
- Apply Knowledge of Integrated Circuits:
    - Utilize integrated circuits to design and analyze electronic systems, focusing on non-inverting and inverting signals.
- Master Phasor Theory:
    - Apply phasor theory to analyze and solve problems in AC circuits, demonstrating proficiency in handling phase relationships.
- Design and Implement Solid State Amplifiers:
    - Design and construct solid-state amplifiers, understanding their characteristics and applications in electronic devices.
- Configure Filters and Power Supplies:
    - Design and implement filters and power supplies, considering their configurations and roles in electronic circuitry.
- Analyze RLC Circuits:

        - Analyze the behavior of circuits containing resistors, inductors, and capacitors (RLC circuits) in various operating conditions.
    - Understand Bandwidth in Circuits:
        - Grasp the concept of bandwidth and its significance in signal processing within electronic circuits.
    - Design and Build Oscillators:
        - Design and build oscillators of different types, gaining practical knowledge of their applications in generating periodic waveforms.
    - Successfully Complete AM Radio Kit Project:
        - Execute hands-on tasks such as inventorying, board stuffing, soldering, calibration, and documentation for an AM radio kit (e.g., AM-550K).
    - Excel in Project-Based Assignments:
        - Successfully complete project-based assignments, applying theoretical knowledge to real-world circuit design and problem-solving.

Assessments

- Integrated Circuit Design Project:
    - Task: Students are tasked with designing and implementing a circuit using integrated circuits to fulfill a specific function (e.g., audio amplifier, signal filter).
        - Assessment Criteria: Evaluation will be based on the functionality of the circuit, accuracy of design calculations, and the clarity of documentation. Students will also present their projects, explaining the theory behind their designs and addressing questions from peers and the instructor.
- Oscillator Calibration and Analysis:
    - Task: Students are provided with oscillator kits and are required to calibrate and analyze the performance of the oscillators under different conditions.
        - Assessment Criteria: Assessment includes the accuracy of calibration, analysis of waveform characteristics, and troubleshooting skills. Students will submit a comprehensive report detailing their observations, analysis, and any modifications made during the process.

Course: Clinical circuits I	Length: Semester

Standards

- 9.3.MN-PPD.1 Produce quality products that meet manufacturing standards and exceed customer satisfaction.
- 9.3.MN-PPD.2 Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
- 9.3.MN-PPD.3 Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
- 9.3.MN-PPD.4 Implement continuous improvement processes in order to maintain quality within manufacturing production.
- 9.3.MN-PPD.5 Develop procedures to create products that meet customer needs.

Essential Question(s)

- How do electronic AC/DC theory principles apply to the design and functionality of circuits in clinical applications?
- What are the key steps and considerations in interpreting and creating schematic diagrams for electronic circuits used in clinical settings?
- How can various test equipment be effectively employed to measure, analyze, and troubleshoot electronic circuits in clinical circuits?
- In what ways does the mastery of soldering and rework techniques contribute to the reliability and longevity of electronic components in clinical environments?
- How does the structured environment and peer inspections enhance the application of total quality management principles in the manufacturing of electronic circuits for clinical use?

Content

- Introduction to Electronic AC/DC Theory:
  - Understanding the fundamental concepts of electronic theory, encompassing both AC and DC circuits.
  - Project-based assignments, trainers, labs, and kits to reinforce theoretical knowledge.
- Project Design and Schematic Interpretation:
  - Developing skills in designing electronic projects and interpreting schematic diagrams.
  - Application of theoretical knowledge to practical project design scenarios.
- Utilization of Test Equipment:
  - Hands-on experience with various test equipment for measuring, analyzing, and troubleshooting electronic circuits.
  - Learning the proper use and interpretation of results from electronic testing tools.
- Soldering and Rework Skills:
  - Acquiring proficiency in soldering techniques and reworking electronic components.
  - Peer inspections to ensure cross-functional learning and adherence to manufacturing principles.
- Mechanical Assembly Techniques:
  - Understanding mechanical assembly in electronic circuits.
  - Applying principles of precision and quality in assembling electronic components.
- Troubleshooting Electronic Circuits:
  - Developing skills in identifying and resolving issues in electronic circuits.
  - Hands-on experience in diagnosing and troubleshooting common problems.
- Structured Environment and Total Quality Management:
  - Working within a structured environment that simulates manufacturing principles.
  - Emphasizing total quality management through peer inspections and collaborative learning.

Skills

- Demonstrate Understanding of Electronic AC/DC Theory:
  - Articulate fundamental concepts of electronic theory, both AC and DC, through theoretical knowledge and practical applications.

- Design and Interpret Schematic Diagrams:
  - Develop the ability to design electronic projects and accurately interpret schematic diagrams.
- Operate Test Equipment Effectively:
  - Utilize various test equipment proficiently for measuring, analyzing, and troubleshooting electronic circuits.
- Master Soldering and Rework Techniques:
  - Demonstrate mastery in soldering techniques and efficiently perform rework on electronic components.
- Execute Precise Mechanical Assembly:
  - Apply precision and quality standards in the mechanical assembly of electronic components.
- Identify and Resolve Circuit Issues:
  - Develop skills in identifying and resolving issues in electronic circuits through systematic troubleshooting.
- Participate in Peer Inspections:
  - Engage in peer inspections to ensure quality control and cross-functional learning in component installation and soldering.
- Apply Total Quality Management Principles:
  - Understand and apply total quality management principles in electronic circuit projects.
- Collaborate in a Structured Environment:
  - Work effectively within a structured environment that simulates manufacturing principles.
- Promote Cross-Functional Learning:
  - Foster cross-functional learning through collaborative peer inspections and project-based assignments.

Assessments

- Clinical Circuit Design Project:
  - Task: Design a clinical electronic circuit that meets specific requirements for a medical application, considering safety, efficiency, and functionality.

        - Assessment Criteria: Evaluation will be based on the accuracy and completeness of the circuit design, adherence to safety standards, successful integration of electronic components, and the ability to troubleshoot and correct any issues.
    - Circuit Analysis and Troubleshooting Lab:
        - Task: Analyze and troubleshoot pre-built electronic circuits commonly used in clinical settings. Identify and rectify faults using appropriate test equipment and procedures.
            - Assessment Criteria: Assessment will focus on the accuracy of circuit analysis, effective troubleshooting techniques, proper use of test equipment, and the ability to communicate findings through a comprehensive report.

Course: Semiconductors Electronics	Length: Semester

Standards

- 9.3.MN-QA.1 Evaluate production operations for product and process quality.
- 9.3.MN-QA.2 Recommend and implement continuous improvement in manufacturing processes.
- 9.3.MN-QA.3 Coordinate work teams to create a product that meets quality assurance standards.
- 9.3.MN-QA.4 Employ project management processes using data and tools to deliver quality, value-added
- products.
- 9.3.MN-QA.5 Perform safety inspections and training to ensure a safe and healthy workplace.
- 9.3.MN-QA.6 Implement continuous improvement processes to maintain quality products.
- 9.3.MN-QA.7 Identify inspection processes that ensure products meet quality specifications.

Essential Question(s)

- What are the fundamental characteristics and applications of diodes in electronic circuits?

- How do bipolar transistors and field-effect transistors differ in terms of operation and circuit applications?
- What testing and troubleshooting techniques are essential for ensuring the integrity of semiconductor components and circuits?
- In what ways can semiconductors be effectively utilized in the design of rectifiers, amplifiers, and power supplies?
- How does the understanding of common collector/emitter configurations enhance the design and analysis of electronic circuits involving semiconductors?

Content

- Introduction to Semiconductors:
  - Purpose and application of semiconductors.
  - Types of semiconductors: diodes, bipolar transistors, common collector/emitter, and field-effect transistors.
- Testing and Measurement Procedures:
  - Techniques for testing, measuring, and troubleshooting semiconductors.
  - Procedures to determine component and circuit integrity.
- Circuit Applications:
  - Application of semiconductors in rectifiers, amplifiers, and power supplies.
  - Hands-on experience through trainers, kits, and project-based assignments.
- Diode Operation and Characteristics:
  - Understanding the operation and characteristics of diodes.
  - Practical applications of diodes in electronic circuits.
- Transistor Types and Configurations:
  - Exploration of bipolar transistors and field-effect transistors.
  - Analysis of common collector/emitter configurations.
- Practical Projects:
  - Implementation of acquired knowledge in real-world projects.
  - Building circuits to reinforce understanding and skills.

Skills

- Understand Semiconductor Basics:
  - Demonstrate a thorough understanding of the purpose and application of various semiconductors, including diodes, bipolar transistors, common collector/emitter, and field-effect transistors.
- Master Testing and Troubleshooting:
  - Acquire skills in testing, measuring, and troubleshooting procedures to assess component and circuit integrity in semiconductor devices.
- Apply Semiconductors in Circuits:
  - Apply semiconductors in practical circuits, including rectifiers, amplifiers, and power supplies, demonstrating the ability to design and implement electronic systems.
- Comprehend Diode Operation:
  - Understand the operation and characteristics of diodes, and apply this knowledge to design and analyze electronic circuits.
- Explore Transistor Types:
  - Explore bipolar transistors and field-effect transistors, understanding their types and configurations, with a focus on common collector/emitter setups.
- Engage in Practical Projects:
  - Apply theoretical knowledge in hands-on, real-world projects, reinforcing concepts and building practical skills in semiconductor electronics.

Assessments

- Semiconductor Circuit Analysis Project:
  - Task: Design a comprehensive project that involves the application of semiconductor components, such as diodes and transistors, in a practical electronic circuit.
    - Assessment Criteria: Evaluation will be based on the effectiveness of the circuit design, accurate analysis of semiconductor behavior, troubleshooting skills, and the ability to articulate the project's purpose and functionality.
- Semiconductor Testing and Troubleshooting Exam:

- Task: Conduct a series of tests and troubleshooting procedures on semiconductor circuits, diagnosing and rectifying potential issues.
  - Assessment Criteria: The assessment will measure the accuracy of testing, proficiency in identifying semiconductor malfunctions, and the application of appropriate troubleshooting techniques. Additionally, students will be evaluated on their ability to document the testing process and provide solutions.

Course: Clinical Circuits II	Length: Semester

Standards

- 9.3.MN-QA.1 Evaluate production operations for product and process quality.
- 9.3.MN-QA.2 Recommend and implement continuous improvement in manufacturing processes.
- 9.3.MN-QA.3 Coordinate work teams to create a product that meets quality assurance standards.
- 9.3.MN-QA.4 Employ project management processes using data and tools to deliver quality, value-added
- products.
- 9.3.MN-QA.5 Perform safety inspections and training to ensure a safe and healthy workplace.
- 9.3.MN-QA.6 Implement continuous improvement processes to maintain quality products.
- 9.3.MN-QA.7 Identify inspection processes that ensure products meet quality specifications.

Essential Question(s)

- How can the principles learned in introduction to electronics, circuits 1 & 2, and semiconductor electronics be effectively combined to address complex challenges in clinical circuits II AC/DC?
- What techniques and strategies are essential for precise inventory, construction, and circuit analysis of diverse electronic projects in a clinical setting?

- In what ways does the integration of advanced circuit analysis using digital multimeters and logic probes enhance the understanding and troubleshooting capabilities of students in clinical circuits II AC/DC?
- How do project-based assignments, such as digital multimeters, analog/digital trainers, logic probes, robotic arm, and all-terrain robot, contribute to the practical application of theoretical knowledge in this course?
- What level of proficiency is expected in utilizing various test equipment for circuit analysis and troubleshooting, and how does this expertise contribute to the successful completion of clinical circuits II AC/DC projects?

Content

- Integration of Electronics Principles:
  - Application of principles learned in Introduction to Electronics, Circuits I & II, and Semiconductor Electronics.
  - Understanding the interplay of AC and DC circuits in complex electronic systems.
- Advanced Circuit Construction:
  - Inventory and construction of electronic projects using diverse components.
  - Proficient use of tools and equipment for building and testing circuits.
- Circuit Analysis and Troubleshooting:
  - Advanced circuit analysis techniques, incorporating digital multimeters and logic probes.
  - Troubleshooting complex circuits to identify and rectify issues.
- Project-Based Assignments:
  - Digital multimeters, analog/digital trainers, logic probes, robotic arm, and all-terrain robot projects.
  - Hands-on application of theoretical knowledge in real-world projects.
- Utilization of Test Equipment:
  - Competence in using various test equipment for circuit analysis and troubleshooting.
  - Interpretation of findings from test equipment to ensure circuit functionality.

Skills

- Apply Electronics Principles:

        - Integrate knowledge from previous modules to solve complex electronic challenges.
        - Demonstrate the application of principles in real-world scenarios.
    - Proficient Circuit Construction:
        - Execute precise inventory and construction of diverse electronic projects.
        - Utilize tools and equipment effectively for circuit assembly.
    - Advanced Circuit Analysis:
        - Conduct in-depth circuit analysis using digital multimeters and logic probes.
        - Identify and resolve complex issues in electronic circuits.
    - Project-Based Proficiency:
        - Successfully complete projects such as digital multimeters, analog/digital trainers, logic probes, robotic arm, and all-terrain robot.
        - Apply theoretical understanding to hands-on project development.
    - Expertise in Test Equipment:
        - Competently use various test equipment for circuit analysis and troubleshooting.
        - Interpret and communicate findings from test equipment accurately.

Assessments

- Integrated Project Assessment:
    - Task: Students will work on an integrated project that involves designing, constructing, and troubleshooting a complex electronic system. This project may include elements such as digital multimeters, analog/digital trainers, and logic probes.
        - Assessment Criteria: Evaluation will be based on the thoroughness of circuit analysis, precision in construction, accurate interpretation of findings, and successful troubleshooting of any issues encountered during the project.
- Circuit Troubleshooting Simulation:
    - Task: Students will engage in a simulated environment where they are presented with malfunctioning circuits. They must use their knowledge and skills acquired in the course to diagnose and rectify the issues within a specified timeframe.

- Assessment Criteria: Assessment will focus on the speed and accuracy of troubleshooting, application of correct circuit analysis techniques, and the ability to effectively communicate the solutions implemented.

Course: Digital I Electronics	Length: Semester

Standards

- 9.3.MN-PPD.1 Produce quality products that meet manufacturing standards and exceed customer satisfaction.
- 9.3.MN-PPD.2 Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
- 9.3.MN-PPD.3 Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
- 9.3.MN-PPD.4 Implement continuous improvement processes in order to maintain quality within manufacturing production.
- 9.3.MN-PPD.5 Develop procedures to create products that meet customer needs.

Essential Question(s)

- What is the fundamental difference between digital and analog systems, and how does it impact information representation in computers?
- How do different number systems, such as binary and hexadecimal, contribute to the internal workings of digital logic circuits?
- What are the essential characteristics and functions of logic gates, and how are they combined to create complex digital circuits?

- How do sequential logic elements, like flip-flops, contribute to the storage and processing of information in digital systems?
- In what ways do multiplexers, demultiplexers, and other advanced digital components enhance the functionality and efficiency of digital circuits?

Content

- Digital Introduction:
  - Understanding the fundamentals of digital systems and their applications.
- Number Systems:
  - Exploring various number systems, including binary, decimal, and hexadecimal.
- Logic Gates:
  - Studying different types of logic gates, their symbols, and truth tables.
- Gate and Logic Circuit Operation:
  - Understanding the operation of gates and how they contribute to logic circuits.
- Combinational Logic:
  - Analyzing combinational logic circuits and their role in digital systems.
- Sequential Logic:
  - Exploring sequential logic circuits and their functioning.
- Multiplexers and Demultiplexers:
  - Learning about the basic principles, operation, and applications of multiplexers and demultiplexers.
- Flip Flops:
  - Understanding the working principles and applications of flip-flops in digital electronics.
- Wiring and Testing:
  - Practical aspects of wiring digital circuits and testing them using tools like logic probes.

Skills

- Understand Digital Systems:
  - Gain a comprehensive understanding of digital systems and their applications.

- Master Number Systems:
  - Proficiently work with various number systems, including binary, decimal, and hexadecimal.
- Operate Logic Gates:
  - Demonstrate the operation of different logic gates, interpret their symbols, and create truth tables.
- Design Logic Circuits:
  - Design and analyze gate and logic circuits for specific applications.
- Implement Combinational Logic:
  - Implement and analyze combinational logic circuits to achieve desired outcomes.
- Work with Sequential Logic:
  - Apply knowledge of sequential logic to design circuits with memory elements.
- Utilize Multiplexers and Demultiplexers:
  - Use multiplexers and demultiplexers in practical scenarios, understanding their functions.
- Apply Flip Flops:
  - Implement flip-flops in digital circuits, demonstrating their sequential operation.
- Wire and Test Circuits:
  - Proficiently wire digital circuits and conduct thorough testing using tools like logic probes.

Assessments

- Digital Circuit Design Project:
  - Task: Design a digital circuit that performs a specific function, such as a binary counter or a digital clock.
    - Assessment Criteria: Evaluate the correctness of the design, efficiency in resource utilization, clarity of circuit diagram, and the ability to troubleshoot and debug any issues.
- Logic Circuit Simulation and Analysis:
  - Task: Use simulation software to model and analyze complex logic circuits, demonstrating their behavior under different input conditions.
    - Assessment Criteria: Assess the accuracy of simulation results, the ability to interpret circuit performance, and the troubleshooting skills in identifying and correcting simulation discrepancies.

Course: Digital II Electronics	Length: Semester

Standards

- 9.3.MN-PPD.1 Produce quality products that meet manufacturing standards and exceed customer satisfaction.
- 9.3.MN-PPD.2 Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
- 9.3.MN-PPD.3 Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
- 9.3.MN-PPD.4 Implement continuous improvement processes in order to maintain quality within manufacturing production.
- 9.3.MN-PPD.5 Develop procedures to create products that meet customer needs.

Essential Question(s)

- How can Boolean logic and Karnaugh mapping be effectively applied in the design of complex logic circuits?
- What challenges and considerations arise when constructing digital lab circuits, and how do these applications reinforce theoretical concepts?
- In what ways can students develop strong troubleshooting skills for identifying and resolving issues in digital circuits?
- How can oral presentations effectively communicate the operation of digital circuits, emphasizing their real-world applications and significance?
- What key insights can be gained from understanding the elements of computer systems, including microprocessor flow charts, individual element functions, and flow analysis?

Content

- Theory and Design of Logic Circuits:
  - Understanding the theory and design principles of logic circuits.
  - Integrating logic operations using Boolean logic and Karnaugh mapping.
- Construction of Digital Lab Circuits:
  - Hands-on construction of challenging digital lab circuits from kits.
  - Reinforcing and explaining logic circuits such as clock circuits, multiplexing, demultiplexing, flip flops, counters, and shift registers.
- Troubleshooting and Test Equipment:
  - Utilizing test equipment for troubleshooting digital circuits.
  - Developing skills in identifying and resolving issues.
- Oral Presentation on Circuit Operation:
  - Delivering an oral presentation on the operation of digital circuits.
  - Discussing applications and real-world relevance.
- Elements of Computer Systems:
  - Exploring elements of computer systems.
  - Understanding microprocessor flow charts, individual element functions, block diagrams, and flow analysis.

Skills

- Logic Circuit Design:
  - Develop proficiency in designing logic circuits based on theoretical concepts, Boolean logic, and Karnaugh mapping.
- Hands-on Circuit Construction:
  - Build and assemble complex digital lab circuits using kits to apply theoretical knowledge in a practical setting.
- Troubleshooting Skills:

        - Acquire the ability to troubleshoot digital circuits using test equipment, identifying and resolving issues effectively.
    - Oral Presentation Skills:
        - Enhance communication skills by delivering clear and informative oral presentations on the operation of digital circuits, emphasizing real-world applications.
    - Understanding Computer Systems:
        - Gain a comprehensive understanding of computer systems, including elements such as microprocessor flow charts, individual element functions, block diagrams, and flow analysis.

Assessments

- Digital Circuit Design Project:
    - Task: Students will be tasked with designing a complex digital circuit based on a specified set of requirements. This project will require the application of Boolean logic, Karnaugh mapping, and the integration of various logic operations. Students will need to construct the circuit using digital lab kits, troubleshoot any issues, and present their design orally, emphasizing its practical applications.
        - Assessment Criteria: The assessment will consider the correctness and efficiency of the circuit design, the accuracy of troubleshooting, and the clarity and effectiveness of the oral presentation.
- Multiplexing and Demultiplexing Lab:
    - Task: Students will engage in a hands-on lab activity focused on multiplexing and demultiplexing circuits. They will use digital lab kits to construct these circuits, troubleshoot potential problems, and analyze their behavior. Additionally, students will be required to write a report detailing their observations and insights from the lab.
        - Assessment Criteria: The assessment will evaluate the accuracy of circuit construction, the ability to troubleshoot and address issues, and the depth and clarity of the lab report, including theoretical understanding and practical application.

Course: Microprocessor Applications I&II	Length: 2 Semesters

Standards

- 9.3.MN-PRO.1 Diagnose production process problems and take corrective action to meet production quality standards.
- 9.3.MN-PRO.2 Manage safe and healthy production working conditions and environmental risks.
- 9.3.MN-PRO.3 Make continuous improvement recommendations based on results of production process audits and inspections.
- 9.3.MN-PRO.4 Coordinate work teams when producing products to enhance production process and performance.
- 9.3.MN-PRO.5 Demonstrate the safe use of manufacturing equipment.

Essential Question(s)

- What are the fundamental architectural components of modern microprocessors, and how do they contribute to the overall functionality of these devices?
- How can programming languages and techniques be effectively applied to microprocessors, and what role do they play in enhancing the capabilities of these devices?
- What are the key considerations and methodologies for interfacing microprocessors with a variety of I/O peripherals, both in terms of hardware and software implementation?
- How do computer I/O and interrupt techniques apply to the processes of analog-to-digital and digital-to-analog conversions in the context of microprocessor applications?
- In what ways can timers and different interfaces be utilized to facilitate parallel and serial communication within microprocessor-based systems, and what are their practical implications?

Content

- Introduction to Microprocessors:

        - Understanding the architecture and basic functionalities of modern microprocessors and microcontrollers.
    - Programming Concepts:
        - Learning programming languages and techniques for microprocessors, emphasizing practical applications.
    - Interfacing Microprocessors:
        - Exploring the interfacing of microprocessors with various I/O peripherals, covering both hardware and software aspects.
    - Computer I/O and Interrupt Techniques:
        - Studying input/output operations and interrupt techniques applied to analog-to-digital and digital-to-analog conversions.
    - Timers and Interfaces:
        - Understanding the use of timers and different types of interfaces for parallel and serial communication.
    - Laboratory Activities - Arduino Construction and Programming:
        - Engaging in hands-on laboratory activities to gain experience in developing hardware and software for microprocessor systems.
    - Real-World Interfacing Problems:
        - Solving real-world interfacing problems using microprocessors, with a focus on Arduino construction, programming, and modifications.

Skills

- Understand Microprocessor Architecture:
    - Comprehend the architecture and functionalities of modern microprocessors and microcontrollers.
- Apply Programming Concepts:
    - Demonstrate proficiency in programming languages and techniques relevant to microprocessors.
- Implement Microprocessor Interfacing:
    - Develop skills in interfacing microprocessors with diverse I/O peripherals, both in hardware and software.

- Master Computer I/O and Interrupt Techniques:
    - Acquire knowledge of input/output operations and interrupt techniques, particularly in analog-to-digital and digital-to-analog conversions.
- Utilize Timers and Interfaces:
    - Apply the use of timers and various interfaces for parallel and serial communication.
- Conduct Laboratory Activities - Arduino Construction and Programming:
    - Gain practical experience through hands-on laboratory activities, constructing and programming Arduino-based systems.
- Solve Real-World Interfacing Problems:
    - Apply microprocessor knowledge to solve real-world interfacing problems, emphasizing Arduino construction, programming, and modifications.

Assessments

- Microprocessor Programming Project:
    - Task: Students are given a microprocessor-based project that involves programming and interfacing. They must choose a real-world application (e.g., temperature control system, digital alarm system) and design the hardware and software components using a microcontroller platform (e.g., Arduino).
        - Assessment Criteria: Evaluation will be based on the effectiveness of the program, successful integration with peripherals, overall system functionality, and the clarity of the presentation explaining the design choices.
- Troubleshooting and Modification Lab:
    - Task: Students are provided with a malfunctioning microprocessor-based system. They must identify and rectify the issues using troubleshooting techniques. Additionally, they are required to implement a specified modification to enhance the system's functionality.
        - Assessment Criteria: Assessment will focus on the accuracy and efficiency of troubleshooting, successful implementation of the modification, and the ability to articulate the troubleshooting process during an oral presentation.

Course: Electronics Independent Projects I&II	Length: 2 Semesters

Standards

- 9.3.MN-PPD.1 Produce quality products that meet manufacturing standards and exceed customer satisfaction.
- 9.3.MN-PPD.2 Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
- 9.3.MN-PPD.3 Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
- 9.3.MN-PPD.4 Implement continuous improvement processes in order to maintain quality within manufacturing production.
- 9.3.MN-PPD.5 Develop procedures to create products that meet customer needs.

Essential Question(s)

- How can independent projects be seamlessly integrated into the electronics classroom to reinforce and apply theoretical knowledge?
- In what ways can students effectively utilize classroom resources, including specialized trainers and equipment, to enhance the quality and depth of their independent projects?
- How does fostering collaboration among students contribute to a culture of peer learning and knowledge sharing within the electronics classroom?
- How can independent projects be strategically aligned with ongoing classroom topics to create a cohesive learning experience and extend the understanding of key concepts?
- What measures should students take to ensure that independent projects adhere to classroom safety protocols and standards within the electronics environment?

Content

- Project-Based Assignments:
  - Students will engage in a series of project-based assignments that integrate the knowledge and skills acquired throughout their electronics coursework. Projects may cover diverse areas such as fire control systems, residential electricity, and motor controls.
- Independent Study:
  - This course emphasizes independent study, allowing students to explore specific topics of interest within the field of electronics. They will have the freedom to choose and delve into projects that align with their career aspirations or personal interests.
- Trainer Utilization:
  - Students will utilize various trainers, including those for fire control systems, residential electricity, and motor controls. Practical hands-on experience with these trainers will enhance their understanding and application of electronics concepts.
- Diversification of Skills:
  - The course aims to broaden students' skill sets by providing exposure to different areas of electronics. This diversification prepares them for a range of opportunities in both the workforce and college.
- ISCET Certifications:
  - The curriculum may incorporate preparation for ISCET (International Society of Certified Electronics Technicians) certifications. Students will have the opportunity to gain industry-recognized certifications, enhancing their credentials for future endeavors.
- Workforce and College Readiness:
  - Through independent projects, students will develop practical skills and proficiencies that make them well-prepared for both entry into the workforce and further academic pursuits in the field of electronics.

Skills

- Classroom Integration:

        - Seamlessly integrate independent projects into the electronics classroom, allowing students to apply theoretical concepts learned in the curriculum to real-world scenarios.
    - Utilization of Classroom Resources:
        - Effectively leverage classroom resources, including specialized trainers and equipment, to enhance the quality and depth of independent projects.
    - Collaboration and Peer Learning:
        - Encourage collaboration among students, fostering a culture of peer learning and knowledge sharing within the electronics classroom environment.
    - Instructor Guidance:
        - Seek guidance and feedback from the instructor, ensuring that independent projects align with the classroom curriculum and meet educational objectives.
    - Classroom-Specific ISCET Certification Preparation:
        - Tailor ISCET certification preparation to align with the specific topics covered in the electronics classroom, ensuring relevance to the curriculum.
    - Integration with Classroom Topics:
        - Align independent projects with ongoing classroom topics, creating a cohesive learning experience that reinforces and extends the knowledge acquired in regular class sessions.
    - Classroom Presentation Skills:
        - Develop presentation skills within the classroom context, allowing students to showcase their independent projects to classmates and the instructor.
    - Classroom Safety Protocols:
        - Adhere to classroom safety protocols and standards while executing independent projects, emphasizing the importance of safe practices in the electronics environment.
    - Classroom-Based Diversification of Skills:
        - Diversify skills within the electronics classroom by selecting projects that complement and extend the topics covered in class, providing a well-rounded learning experience.
    - Classroom Time Management:
        - Manage project timelines effectively within the constraints of the classroom schedule, ensuring that independent projects contribute positively to the overall learning experience.

Assessments

- Classroom Integration Assessment:
  - Task: Develop and present an independent project proposal that seamlessly integrates with the current electronics classroom curriculum.
    - Assessment Criteria: Alignment with classroom topics, clear demonstration of theoretical knowledge application, relevance to educational objectives.
- Resource Utilization and Collaboration Assessment:
  - Task: Execute an independent project while effectively leveraging classroom resources and fostering collaboration with peers.
    - Assessment Criteria: Efficient use of specialized trainers and equipment, evidence of peer collaboration, contribution to a culture of knowledge sharing.

Resources

➔ Course Resources

- Essential Electronics second edition, Frank Petruzella, Isbn # 978-0-07-4027, year 2001
- Grob's basic Electronics 11 edition, Michael E Schultz ISBN 978-0-07-351085-9, year2013
- Digital Electronics principles & application, 7th edition Roger Tokheim, ISBN 978-0-07-312634-0 year 2008