

Implementation Date

Fall 2010

PROGRAM CONCENTRATION: Architecture, Construction,
Communication, Transportation
CAREER PATHWAY: Marine Engine Technology
COURSE TITLE: Marine Electrical Systems (MES)

This course introduces students to electromagnetic and electrical theory and their application to marine engine systems. Theoretical topics will include electromagnetic theory, electrical theory, test equipment, and Ohm's Law. This course teaches skills related to diagnosis, service, and repair of batteries, starting systems, starting system components, alternators, and regulators. Topics include battery applications and service, principles of starting and charging systems, starting system components, recoil starter servicing, ignition systems, charging system components, and diagnostic procedures. Mastery of these standards through project-based learning and leadership development activities of Skills USA will help prepare students with a competitive edge for the transportation logistics marketplace.

Electromagnetic and Electrical Theory

ACCT-MES-1. Students will demonstrate knowledge of electromagnetic and electrical theory, circuit analysis, and electrical system diagnosis and repair. Students will:

- a. Explain the basic principles of magnetism.
- b. Explain basic electrical theory.
- c. Define and create basic DC and AC circuits as well as describe their differences.
- d. Locate and identify electrical circuit components.
- e. Identify types of analog and digital meters used in marine electrical servicing.
- f. Set up and use analog and digital voltmeters, ammeters, and ohmmeters.
- g. Diagnose circuit problems using digital multi-meter to record voltage drop.
- h. Measure and record circuit readings using a VOA meter.
- i. Define Ohm's Law and the relationship among voltage, amperage, and resistance.
- j. Describe a series and a parallel circuit.
- k. Analyze circuit problems using Ohm's Law.
- l. Identify stray voltage causes in salt and fresh water boating environments.

Academic Standards:

ELA11W3 Students will use research and technology to support writing. The student:

- a. Formulates clear research questions and utilizes appropriate research venues (e.g. library, electric media, personal interview, survey) to locate and incorporate evidence from primary and secondary sources.*
- b. Uses supporting evidence from multiple sources to develop the main ideas within the body of a researched essay, a composition, or a technical document.*

Implementation Date

Fall 2010

- a. *Uses systematic strategies to organize and record information (e.g. anecdotal scripting, annotated bibliographies).*

MM1-4P1 Students will solve problems using appropriate technology. The student:

- b. *Solve problems that arise in mathematics and in other contexts.*
- c. *Apply and adapt a variety of appropriate strategies to solve problems.*

SPS10 Students will investigate the properties of electricity and magnetism.

- b. *Explain the flow of electrons in terms of alternating and direct current, the relationship among voltage, resistance and current, simple series and parallel circuits.*

Battery Application and Service

ACCT-MES-2. Students will safely demonstrate knowledge of battery concepts, diagnosis, maintenance, and repair. Students will:

- a. Describe different types of batteries and their application.
- b. Set up and use test equipment to troubleshoot batteries.
- c. Safely perform battery state of charge test and determine necessary action.
- d. Perform battery capacity test and confirm proper battery capacity for vessel application and then determine necessary action.
- e. Perform battery charge.
- f. Inspect, clean, fill and/or replace battery, battery cables, connectors, clamps, and hold downs.
- g. Start a vessel using auxiliary power supply.
- h. Identify electronic modules and other accessories that require re-initialization and code entry after battery disconnect.

Academic Standards:

SC7 Students will characterize the properties that describe solutions and the nature of acids and bases. The student:

- b. *Compare, contrast, and evaluate, the nature of acids and bases:*
 - *pH*
 - *Acid-Base neutralization*

SPS6 Students will investigate the properties of solutions. The student:

- a. *Describe solutions in terms of: solute/solvent, conductivity, concentration.*

SPS10 Students will investigate the properties of electricity and magnetism. The student:

- b. *Explain the flow of electrons in terms of alternating and direct current, the relationship among voltage, resistance and current, simple series and parallel circuits.*

Implementation Date

Fall 2010

Starting and Charging Diagnosis and Repair

ACCT-MES-3. Students will demonstrate knowledge of starting system concepts, diagnosis, maintenance, and repair. Students will:

- a. Perform starter current draw tests and determine necessary action.
- b. Perform starter circuit voltage drop tests and determine necessary action.
- c. Inspect and test starter relays and solenoids and determine necessary action.
- d. Remove and install starter in a vessel.
- e. Inspect and test switches, connectors, and wires of starter control circuits and perform necessary action.
- f. Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.

Academic Standards:

SPS10 Students will investigate the properties of electricity and magnetism. The student:

- b. Explain the flow of electrons in terms of: alternating and direct current, the relationship among voltage, resistance, and current, and simple series and parallel circuits.*

SCSh4 Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

- a. Develop and use systematic procedures for recording and organizing information.*
- b. Use technology to produce tables and graphs.*
- c. Use technology to develop, test, and revise experimental or mathematical models.*

ACCT-MES-4. Demonstrate knowledge of charging system concepts, diagnosis, maintenance, and repair. Students will:

- a. Perform charging system output test and determine necessary action.
- b. Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.
- c. Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners and check pulley and belt alignment.
- d. Perform charging circuit voltage drop tests and determine necessary action.

Academic Standards:

SPS7 Students will relate transformations and flow of energy within a system.

- a. Identify energy transformations within a system (e.g. lighting of a match).*

SCSh4 Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

- a. Develop and use systematic procedures for recording and organizing information.*

Implementation Date

Fall 2010

- b. Use technology to produce tables and graphs.*
- c. Use technology to develop, test, and revise experimental or mathematical models.*

Implementation Date
Fall 2010

Reading Across the Curriculum

Reading Standard Comment

After the elementary years, students engage in reading for learning. This process sweeps across all disciplinary domains, extending even to the area of personal they experience text in all genres and modes of discourse. In the study of various disciplines of learning (language arts, mathematics, science, social studies), students must learn through reading the communities of discourse of each of those disciplines. Each subject has its own specific vocabulary, and for students to excel in all subjects, they must learn the specific vocabulary of those subject areas in context.

Beginning with the middle grades years, students begin to self-select reading materials based on personal interests established through classroom learning. Students become curious about science, mathematics, history, and literature as they form contexts for those subjects related to their personal and classroom experiences. As students explore academic areas through reading, they develop favorite subjects and become confident in their verbal discourse about those subjects.

Reading across curriculum content develops both academic and personal interests in students. As students read, they develop both content and contextual vocabulary. They also build good habits for reading, researching, and learning. The Reading Across the Curriculum standard focuses on the academic and personal skills students acquire as they read in all areas of learning.

Students will enhance reading in all curriculum areas by:

- a. Reading in all curriculum areas
 - Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
 - Read both informational and fictional texts in a variety of genres and modes of discourse.
 - Read technical texts related to various subject areas.
- b. Discussing books
 - Discuss messages and themes from books in all subject areas.
 - Respond to a variety of texts in multiple modes of discourse.
 - Relate messages and themes from one subject area to messages and themes in another area.
 - Evaluate the merit of texts in every subject discipline.
 - Examine author's purpose in writing.
 - Recognize the features of disciplinary texts.
- c. Building vocabulary knowledge
 - Demonstrate an understanding of contextual vocabulary in various subjects.
 - Use content vocabulary in writing and speaking.

Implementation Date
Fall 2010

- Explore understanding of new words found in subject area texts.

Implementation Date
Fall 2010

d. Establishing context

- Explore life experiences related to subject area content.
- Discuss in both writing and speaking how certain words are subject area related.
- Determine strategies for finding content and contextual meaning for unknown words.

CTAE Foundation Skills

The Foundation Skills for Career, Technical and Agricultural Education (CTAE) are critical competencies that students pursuing any career pathway should exhibit to be successful. As core standards for all career pathways in all program concentrations, these skills link career, technical and agricultural education to the state's academic performance standards.

The CTAE Foundation Skills are aligned to the foundation of the U. S. Department of Education's 16 Career Clusters. Endorsed by the National Career Technical Education Foundation (NCTEF) and the National Association of State Directors of Career Technical Education Consortium (NASDCTEc), the foundation skills were developed from an analysis of all pathways in the sixteen occupational areas. These standards were identified and validated by a national advisory group of employers, secondary and postsecondary educators, labor associations, and other stakeholders. The Knowledge and Skills provide learners a broad foundation for managing lifelong learning and career transitions in a rapidly changing economy.

CTAE-FS-1 Technical Skills: Learners achieve technical content skills necessary to pursue the full range of careers for all pathways in the program concentration.

CTAE-FS-2 Academic Foundations: Learners achieve state academic standards at or above grade level.

CTAE-FS-3 Communications: Learners use various communication skills in expressing and interpreting information.

CTAE-FS-4 Problem Solving and Critical Thinking: Learners define and solve problems, and use problem-solving and improvement methods and tools.

CTAE-FS-5 Information Technology Applications: Learners use multiple information technology devices to access, organize, process, transmit, and communicate information.

Implementation Date

Fall 2010

CTAE-FS-6 Systems: Learners understand a variety of organizational structures and functions.

CTAE-FS-7 Safety, Health and Environment: Learners employ safety, health and environmental management systems in corporations and comprehend their importance to organizational performance and regulatory compliance.

CTAE-FS-8 Leadership and Teamwork: Learners apply leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

CTAE-FS-9 Ethics and Legal Responsibilities: Learners commit to work ethics, behavior, and legal responsibilities in the workplace.

CTAE-FS-10 Career Development: Learners plan and manage academic-career plans and employment relations.

CTAE-FS-11 Entrepreneurship: Learners demonstrate understanding of concepts, processes, and behaviors associated with successful entrepreneurial performance.