Advanced Shipboard Engineering

PEIMS Code: N1304667
Abbreviation: ADVSE
Grade Level(s): 11-12
Award of Credit: 1.0

Approved Innovative Course

- Districts must have local board approval to implement innovative courses.
- In accordance with Texas Administrative Code (TAC) §74.27, school districts must provide instruction in all essential knowledge and skills identified in this innovative course.
- Innovative courses may only satisfy elective credit toward graduation requirements.
- Please refer to TAC §74.13 for guidance on endorsements.

Course Description:

The Advanced Shipboard Engineering course includes advanced knowledge of the function, design, and relationships of the systems and components of propulsion and habitability systems. This course will build on knowledge and skills established in the Principles of Maritime Science and Introduction to Shipboard Engineering courses. This course is designed to provide advanced training for employment, licensures, or post-secondary degree programs in the shipboard engineering industry. Instruction includes functions and components of cooling, fuel, lubricating, electrical, air conditioning and refrigeration, propulsion, and mechanical systems of maritime diesel engines. In addition, the students will receive instruction in safety, engine instruments, and environmental compliance.

Essential Knowledge and Skills:

(a) General Requirements. This course is recommended for students in Grades 11-12. Recommended prerequisite: Introduction to Shipboard Engineering. Students shall be awarded *one* credit for the successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

(3) Advanced Shipboard Engineering includes advanced knowledge of the function, design, and relationships of the systems and components of propulsion and habitability. Instruction includes functions and components of cooling, fuel, fuel transfer systems, lubricating, lubricating transfer systems, electrical, air conditioning and refrigeration, propulsion, and mechanical systems of maritime diesel engines. In addition, the students will receive instruction in safety, engine instruments, and environmental compliance.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to

(A) achieve employability skills and standards such as attendance, on-time arrival, meeting deadlines;

(B) explain the importance of working toward personal/team goals every day; and

(C) demonstrate approved/ethical use of maritime technology.

(2) The student examines maritime engineering practices such as design, operation and maintenance of watercraft propulsion and on-board systems and oceanographic technology. The student is expected to:

(A) identify career development and entrepreneurship opportunities related to transportation systems and maritime engineering;

(B) identify careers in transportation systems;

(C) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation within transportation;

(D) discuss certification opportunities;

(E) identify employers' expectations, appropriate work habits, ethical conduct, legal responsibilities, understanding of occupational health and safety, and good citizenship skills;

(F) evaluate and apply appropriate responses to various work scenarios such as emergencies, maintenance, and other identified work related scenarios: and

(G) explore career goals, objectives, and strategies as part of a plan for future career opportunities.

(3) The student evaluates the air conditioning and refrigeration systems on ships. The student is expected to:

(A) identify the functional characteristics of air conditioning and refrigeration systems including temperature and conversion, measurement, heat, laws, methods, flow, hydrochlorofluorocarbons, chlorofluorocarbons;

(B) identify the refrigerant safety precautions as stated in the National Refrigeration Safety Code of Refrigerant Group;

(C) describe necessary precautions and first aid treatment for refrigerant injuries;

(D) list the proper procedures for alignment, record system parameters, and securing refrigeration systems;

(E) identify and describe the function of various refrigeration system components such as refrigerant cylinders, vacuum pumps, metering devices, evaporators, valves, coils, and gauges;

(F) describe the four stages and areas of pressure in a basic refrigeration cycle;

(G) explain the environmental regulations regarding the capture, recovery, and alignment of refrigerant liquids and gases;

(H) identify functional characteristics of heating and ventilation systems; and

(I) demonstrate cleaning procedures for vent coils and condensation drains.

(4) The student examines aspects of electricity. The student is expected to:

(A) explain general safety practices and shipboard safety precautions for working around electrical and electronic equipment;

(B) describe hazards, precautions, and safety practices to avoid electric shock and describe precautions for working on energized circuits, power tools, and equipment;

(C) discuss the theory of electron flow and the relationship between current, voltage, and resistance;

(D) label the components of a simple circuit;

(E) describe the principles of magnetism;

(F) explain the three basic properties of all electrical components and how to safely report isolate electrical components;

(G) identify the function and demonstrate proper use of electrical measurement tools such as digital multimeter, clamp-on ammeter, and megohmmeter; and

(H) explain the theory of direct current associated with starting, charging, lighting, steering, troubleshooting procedures, and engine alarm circuits and test these types of direct current circuits.

(5) The student explains the electronic system on ships. The student is expected to:

(A) identify types of shipboard batteries, safety issues and safety equipment associated with battery installation and maintenance;

(B) explain amperage and voltage changes in a series or parallel battery circuits;

(C) perform a battery load test using a battery load tester;

(D) identify when it is appropriate to add distilled water or electrolyte in a wet cell battery;

(E) measure specific gravity using a hydrometer;

(F) identify the differences between initial, boost, normal, and floating charges;

(G) demonstrate wiring and connector techniques by measuring diameter of a conductor using a wire gauge;

(H) determine proper replacement wire using the wire gauge selection table;

(I) identify the color codes for terminal lug and splice insulation;

(J) explain the AC generator cycle;

(K) describe the principle of operation for an engine heater;

(L) compare single-phase and three-phase AC power;

(M) identify schematic symbols associated with electronics; and

(N) troubleshoot the common types of diagrams and schematics.

(6) The student demonstrates knowledge of maritime diesel engines. The student is expected to:

(A) summarize the characteristics of a diesel engine such as bore and stroke, degree of crankshaft rotation, firing order, compression and horsepower;

(B) list the different strokes of maritime diesel engines such as, four-stroke power cycle, intake stroke, fuel injection and the compression stroke, power stroke, exhaust stroke, four stroke scavenging and blower use, two-stroke power cycle, scavenging and supercharging, two stroke scavenging;

(C) identify the operation and function of the maritime diesel engine stationary components such as engine mounts, sub-base, foundation bolts, cylinder block, crankcase and oil pan, cylinder head, and cylinder head gasket;

(D) describe the operation and function of the diesel engine reciprocating components;

(E) explain the operation and function of the valve actuating mechanism in a diesel engine such as the camshaft and valves, cam lobe, lifters, tappets, pushrods, rocker arms, valves, valve bridge, poppet valve, exhaust valves, intake valves, valve seat insert, and valve spring;

(F) describe the components of the intake and exhaust system and their functions such as the air cleaner, viscous air filter, oil bath filter, air intake silencer, turbocharger, water-cooled after-cooler, blower, air-cooled intercooler, roots blower, air-cooled exhaust manifold, water-cooled exhaust manifold, muffler, tail pipe, and wet muffler;

(G) identify the types of cooling systems such as heat removal and transfer, open cooling systems, closed cooling systems, pressurized closed cooling systems, and vented closed cooling systems;

(H) describe the components of a maritime diesel engine lubricating (lube) oil system such as lube oil cooler, sump, suction screen, oil pump, relief valve, regulating valve, pressure differential gauges, bypass valve, main

oil galleries, priming pumps, alarms, filtering systems, and flow systems; and

(I) describe the maritime diesel engine fuel oil system components such as fuel tank, fuel strainers, fuel filters, fuel transfer pump, high-pressure pump, spray nozzle, fuel injection system, unit injector, electronic unit injector, and common rail type electronic control.

(7) The student distinguishes between the tools necessary to repair, service, and maintain maritime diesel engines. The student is expected to:

(A) demonstrate the proper use of torque wrenches, micrometers, and calipers to service or repair a diesel engine;

(B) describe the function and safety requirements of and demonstrate the proper use of dial indicators;

(C) describe the function and safety requirements of and demonstrate the proper use of gauges such as telescoping gauges, depth gauge, cylinder bore gauge, and thickness gauges;

(D) compare the function and safety requirements of and demonstrate the proper use of a gear and bearing puller;

(E) explain the function and safety requirements of and demonstrate the proper use of pliers such as snap ring pliers and lock- wire pliers;

(F) demonstrate the proper use of the hydraulic press; and

(G) identify the function and safety requirements of and demonstrate the proper use of a machinist rule.

(8) The student examines aspects of ship propulsion. The student is expected to:

(A) compare the functions of bearings such as the strut, the stern tub, spring, and clutches thrust bearing;

(B) explain the functions of the propeller;

(C) describe the functions of the main shaft; and

(D) discuss the functions of the main reduction gear.

Recommended Resources and Materials:

USCG Directives. (n.d.). Retrieved March 22, 2017, from https://www.uscg.mil/directives/listing_cim.asp?id=16000-16999

Standards of Training, Certification, and Watchkeeping (STCW). (n.d.). Retrieved March 22, 2017, from https://www.uscg.mil/nmc/stcw

Master--Adams, L. W., & Coder--Mckinlay, J. (n.d.). United States Coast Guard's National Maritime Center. Retrieved March 22, 2017, from https://www.uscg.mil/nmc/

Textbook:

Blank, D. A. (2005). Introduction to naval engineering. Place of publication not identified: Naval Inst Press.

Recommended Course Activities:

- Research Industry speakers
- Interviews with industry personnel
- Multi-media videos
- Visits to industry sites
- Written papers
- Teacher-created tests
- Operation of industry tools
- Ship Channel Field Experiences
- Online Learning Engine Models

Suggested methods for evaluating student outcomes:

Student outcomes will be evaluated through classroom/homework assignments, independent and group projects, and teacher-developed assessments.

Teacher qualifications:

An assignment for Principle of Maritime Science is allowed with on the of the following certificates:

- Trade and Industrial Education: Grades 6-12. This assignment requires appropriate work approval.
- Trade and Industrial Education: Grades 8-12. This assignment requires appropriate work approval.
- Vocational Trades and Industry. This assignment requires appropriate work approval.

Recommended: Merchant Mariners Credentials; Engineering Rating; Maritime Administration

Degree

Additional information: