

# MARE - MARINE ENGR TECHNOLOGY (MARE)

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## MARE 100 Marine Engineering Fundamentals

**Credits 3. 2 Lecture Hours. 3 Lab Hours.**

A study of basic marine engineering systems, with emphasis on propulsion plants. Introduction to propulsion plant machinery and shipboard safety practices and equipment; offshore oil production; subsea technologies; petroleum product transport and refinery.

## MARE 111 Methods in Engineering Technology

**Credits 2. 1 Lecture Hour. 3 Lab Hours.**

Analytical methods in engineering technology; problem solving, critical thinking, inductive and deductive reasoning, units and conversions, use of computational software, project management; basic calculations in statics, thermodynamics, electric circuits, engineering economics.

## MARE 112 Graphics for Engineering Technology

**Credits 2. 1 Lecture Hour. 3 Lab Hours.**

Graphical communication in engineering and engineering technology; lettering, sketching techniques, geometric construction, multi-view drawings, dimensioning and notation, piping and electrical diagrams, use of 2-D and 3-D CAD software, use of parametric software.

## MARE 200 Basic Operations

**Credits 4. 4 Lecture Hours.**

Practical application of student's classroom studies while at sea on training ship during sea-training period. Student required to complete several projects relating to engineering plant of ship.

**Prerequisite:** Grade of C or better in MART 103.

## MARE 202 Marine Thermodynamics

**Credits 3. 3 Lecture Hours.**

Energy Concepts; First and second law of thermodynamics; Carnot and Rankine principles and reversible heat cycles; Properties of processes of vapors; vapor-power cycles and vapor refrigeration cycles.

**Prerequisites:** MARE 100 or MARR 101; MATH 152 or MATH 161; or concurrent enrollment.

## MARE 205 Engineering Mechanics I

**Credits 3. 3 Lecture Hours.**

Statics, basic vector operations, mechanics of particles and rigid bodies. Center of gravity, analysis of structures, friction, moments of inertia.

**Prerequisites:** Grade of C or better in MATH 151; grade of C or better in PHYS 218 or PHYS 206.

## MARE 206 Engineering Mechanics II

**Credits 3. 3 Lecture Hours.**

Dynamics; scalar and vector solutions of relative linear velocities and acceleration; kinetics; dynamics of translation and rotation; work; energy; impact; momentum.

**Prerequisite:** Grade of C or better in MARE 205.

## MARE 207 Electrical Power I

**Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Application of circuit analysis principles to DC and AC circuits having sources and passive inductors, resistors and capacitors; electrical instrumentation; power and voltage/current phase relationships in AC circuits; balanced three-phase AC power circuits; cable sizing.

**Prerequisites:** Grade of C or better in MATH 151; grade of C or better in PHYS 208 or PHYS 207, or concurrent enrollment.

## MARE 209 Mechanics of Materials

**Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Introduction to the study of stresses, strains, and deformation of a solid body which results when static forces are applied. Transformation of stresses and strains, torsion, beam deflection, and combined loadings are discussed.

**Prerequisite:** Grade of C or better in MARE 205.

## MARE 210 Metallurgy for Marine Engineers

**Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Introduction to structure, properties and engineering application of ferrous and nonferrous materials; beneficiation, production of ferrous and nonferrous metals, destructive and nondestructive testing, protective coatings, strengthening and heat treatment; laboratory includes metallographic procedures, mechanical testing, heat treatment, surface treatment, corrosion testing, recrystallization and failure analysis.

**Prerequisites:** CHEM 107 and CHEM 117.

## MARE 211 Steam Propulsion Plants

**Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Fossil fuel steam generators, shipboard propulsion turbines and condensers, reduction gears, line shafting, internal fittings and fluid flow paths, automatic controls, regulatory requirements for safety device settings, system tests and inspections, boiler water and feed water test and treatment, turbine and reduction gear lubrication, computer aided heat balances, parametric analysis of plant performance.

## MARE 217 Circuit Analysis

**Credits 4. 3 Lecture Hours. 3 Lab Hours.**

Electric and magnetic principles of components used in DC and AC circuits; transient analysis; phasor analysis; Ohm's and Kirchhoff's laws, Thevenin's and Norton's theorems, mesh and nodal equations; measurement of current, voltage and waveforms with meters and oscilloscopes.

**Prerequisites:** Grade of C or better in MATH 151; PHYS 208 or PHYS 207 or concurrent enrollment.

## MARE 242 Manufacturing Methods I

**Credits 2. 1 Lecture Hour. 3 Lab Hours.**

Introduction to manufacturing methods used in marine industries emphasizing fabrication techniques including oxy-acetylene cutting and welding, brazing, arc welding, pipe welding and sheet metal fabrication. Laboratory exercises will develop the knowledge and skills needed to perform fabrication operations, routine maintenance and emergency repairs of marine engineering structures and systems.

## MARE 243 Manufacturing Methods II

**Credit 1. 0 Lecture Hours. 3 Lab Hours.**

Continued introduction to manufacturing methods used in marine industries including machine, foundry and forge work and other manufacturing technologies. Laboratory emphasizes machine shop practices including safety, use and care of machine and hand tools; measuring instruments, layout, gauging, cutting speeds and feeds, drilling, tapping, threading, turning and milling.

**Prerequisite:** Approval of Instructor.

## MARE 261 Engineering Analysis

**Credits 3. 3 Lecture Hours.**

Review of mathematical concepts previously studied (e.g., complex quantities, vectors and calculus), coupled with study of advanced concepts (e.g., differential equations, Laplace Transforms, statistics and numerical methods) with a view to emphasize applications in nuclear engineering, electrical engineering, thermodynamics, heat transfer and turbine theory.

**Prerequisite:** MATH 152 or MATH 161.

**MARE 285 Directed Studies****Credits 1 to 4. 1 to 4 Other Hours.**

Special problems in marine engineering technology not covered by any other course in the curriculum; work may be in either theory or laboratory.

**Prerequisite:** Approval of department head.**MARE 289 Special Topics****Credits 1 to 5. 0 to 5 Lecture Hours. 3 to 5 Lab Hours.**

Selected topics in an identified area of marine engineering technology. May be repeated for credit.

**Prerequisite:** Approval of instructor.**MARE 300 Intermediate Operations****Credits 4. 4 Lecture Hours.**

Training program for second sea-training period. Sea project required of each student under supervision of officer-instructors. Lifeboat and safety training.

**Prerequisite:** Junior or senior classification or approval of instructor.**MARE 305 Fluid Mechanics Theory****Credits 4. 3 Lecture Hours. 2 Lab Hours.**

Theory of incompressible and compressible fluid flow, introduction to fluid power systems and controls, and dynamics of turbomachinery. Mathematical analysis of piping systems to determine pump head, system resistance, and pipe sizing optimization. Topics include physical properties of fluids, continuity equation, Bernoulli's Equation, Darcy's Equation, series and parallel flow, relative roughness, friction factors, dimensional analysis, and laws of similitude.

**Prerequisite:** Junior or senior classification or approval of instructor.**MARE 306 Electrical Power II****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Electrical power generation and distribution; AC and DC rotating machinery; transformers; controllers and safety devices; operation, maintenance and repair procedures and practices; static converters AC/DC and DC/AC that are used in modern electric propulsion systems.

**Prerequisite:** Grade of C or better in MARE 207.**MARE 307 Marine Electronics****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Introduction to the theory of electronic circuits. Fundamentals and basic concepts of semiconductors; solid-state components; power supplies; amplifiers; inverters; rectifiers; oscillators; digital and analog integrated circuits. Application in automation, motor controllers, battery-charging systems, communications; and propulsion plant monitoring systems.

**Prerequisite:** Grade of C or better in MARE 207.**MARE 309 Marine Construction Materials****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Introduction to materials science and engineering, structural, property relationships; advanced manufacturing techniques from the point of view of marine applications such as subsea pipelines, ship hulls, etc.; corrosion and biofouling. Laboratory includes experimental testing of materials properties, materials syntheses and heat treatment techniques.

**Prerequisite:** CHEM 107 and CHEM 117.**MARE 312 Diesel Propulsion Plants****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Marine Diesel Engines. Comprehensive study of diesel engines, thermodynamics of air standard cycles, actual compression ignition engine cycles, emissions and emission controls, fuel injection systems and turbo charging systems, engine material properties, operational parameters including forces and temperatures resulting from combustion and inertial dynamics. Laboratory includes computer-aided parametric analysis of engine performance and use of low-speed diesel propulsion plant simulator.

**Prerequisites:** MARE 305, MARE313. Junior or senior classification or approval of instructor.**MARE 313 Heat Transfer****Credits 3. 3 Lecture Hours.**

Fundamentals of heat transfer modes and different solution techniques; 1-D and 2-D heat conduction in transient and steady state conditions; convection heat transfer under different flow conditions; forced convection in internal and external flows; analysis and selection of heat exchangers; and, thermal radiation heat transfer.

**Prerequisite:** MARE 261; MARE 305 or concurrent enrollment; grade of C or better in MARE 202.**MARE 315 Thermodynamics for Technologists****Credits 4. 3 Lecture Hours. 2 Lab Hours.**

Thermal and mechanical energy transformations; relationships applied to flow and non-flow processes in power and refrigeration cycles; devices include compressors, turbines, heat exchangers, nozzles, diffusers, pumps and piston-cylinder models; computer modeling.

**Prerequisites:** Grade of C or better in PHYS 206 or PHYS 218.**MARE 317 Marine Analog Electronics****Credits 4. 3 Lecture Hours. 3 Lab Hours.**

Study of semiconductor devices including diodes, field effect transistors, bipolar junction transistors and operational amplifiers; applications include signal conditioning, power supplies, active filters, discrete transistor amplifiers and transistor switching/driver circuits.

**Prerequisites:** Grade of C or better in ESET 210 or MARE 207.**MARE 318 Strength of Materials****Credits 4. 3 Lecture Hours. 2 Lab Hours.**

Stress and strain; elastic moduli Poisson's ratio; torsion, bending, unsymmetrical bending; design of beams and shafts; deflection of beams; buckling of columns; material and strength characterization laboratory tests.

**Prerequisites:** MMET 207 or MARE 210; MMET 275 or MARE 205.**MARE 350 Commercial Cruise Internship****Credits 4. 4 Other Hours.**

Training program for second sea-training period; sea project required of each student under supervision of officer-instructors; lifeboat and safety training.

**Prerequisites:** MARE 100, MARE 200, MART 103. Junior or senior classification or permission of MARR and MART department heads.**MARE 399 High Impact Experience in Marine Engineering Technology****Credits 0. 0 Lecture Hours. 0 Lab Hours. 0 Other Hours.**

Participation in an approved high-impact learning practice; reflection on professional outcomes from engineering body of knowledge; documentation and self-assessment of learning experience at mid-curriculum point. Must be taken on a satisfactory/unsatisfactory basis.

**Prerequisite:** Junior or senior classification.

**MARE 400 Advanced Operations****Credits 4. 4 Lecture Hours.**

Training program for third sea-training period. At the end of this period each student will have achieved the knowledge and will have demonstrated the ability to take complete charge of a modern marine power plant while underway at sea.

**Prerequisite:** Junior or senior classification or approval of instructor.**MARE 401 Marine Auxiliary Systems****Credits 3. 2 Lecture Hours. 2 Lab Hours.**

Study of the principal shipboard auxiliary systems, including auxiliary fired-boilers, sea water service, ballast, freshwater service, lubricating oil, fuel oil storage and transfer, distilling, refrigeration and steering systems; major components, operation and maintenance, and interrelationship with other auxiliary systems.

**Prerequisites:** MARE 100, or MARR 101 with a grade of C or better.**MARE 402 Shipboard Automation and Control****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Study of automation in marine power plants; including electronic and pneumatic proportional, integral and derivative control elements; applications in boiler combustion and water level control; engine speed control; remote sensing and performance monitoring systems.

**Prerequisites:** MARE 307.**MARE 405 Fundamentals of Naval Architecture****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Ship geometry and arrangement; ship-form calculations; intact and damaged stability; ships' structure; fundamentals of resistance and propulsion; ship motion, maneuverability, and control; introduction to ship design, construction, and overhaul.

**Prerequisites:** Junior or senior classification or approval of instructor.**MARE 424 Gas Turbine Power Generation****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Application of the Brayton cycle to gas turbine power cycles, including ideal gas cycle analysis, compressor design and construction, gas turbine construction, operation and maintenance for marine and industrial installations.

**Prerequisite:** Grade of C or better in MARE 202 and MARE 205; MARE 309 or concurrent enrollment and approval of instructor.**MARE 434 Offshore Energy, Oil, and Gas Production****Credits 3. 3 Lecture Hours.**

Orientation to the offshore and gas industry; petroleum exploration, production, and marketing; platform and floating production facilities; operations; classification of production systems; economics and risk management.

**Prerequisite:** Junior or senior classification or approval of instructor.**MARE 437 Applied Finite Element Analysis****Credits 3. 3 Lecture Hours.**

Fundamental finite element techniques; direct approach and energy formulation; element equations; assembly and solution schemes; computer implementation; applications to field problems.

**Prerequisites:** MARE 209 and MARE 261.**MARE 441 Engineering Economics and Project Management****Credits 3. 3 Lecture Hours.**

Analysis of engineering economics and management, using costs and benefits of various engineering options. Topics include time value of money, cash flows, analysis techniques, interests rates, inflation, depreciation, optimization, statistics, network analysis and critical path programming.

**Prerequisite:** Junior or senior classification or advisor approval.**MARE 442 Advanced Manufacturing Processes****Credits 3. 3 Lecture Hours.**

. Non-traditional manufacturing processes including ultrasonic machining, abrasive jet machining, water jet cutting, electro-mechanical machining, electric discharge machining, plasma arc machining and chemical milling that are used to optimize production in the manufacturing and shipbuilding industries.

**Prerequisite:** MARE 242 and MARE 243.**MARE 443 Lean Sigma-Six Methodology****Credits 3. 3 Lecture Hours.**

History of lean and six sigma philosophies, their principles and implementation methodologies for creating a world class enterprise; topics in lean include five s, value stream mapping, cellular manufacturing, pull system, performance metrics, lean supplier network, lean product development, lean implementation models and impact of these technologies on the society.

**Prerequisite:** MARE 242 and MARE 243.**MARE 451 Senior Design Project I****Credits 2. 1 Lecture Hour. 3 Lab Hours.**

Design, modeling, testing and validation processes; design of equipment, components or systems for marine and related power generation applications; complete design process including definition of the problem, research for existing designs and related technologies, conceptualization and evaluation of alternatives, development of preliminary design, refining and generation of final design and documents.

**Prerequisites:** MARE 206, MARE 209, MARE 305, MARE 306, MARE 307, and MARE 313, or concurrent enrollment; senior classification.**MARE 452 Senior Design Project II****Credits 2. 1 Lecture Hour. 3 Lab Hours.**

This course is a continuation of MARE 451. Development of theoretical, computational or experimental models using the design developed in MARE 451. Formulation, construction and/or fabrication work. Refining, experimenting and testing of models considering alternatives. Analyzing results and preparing and submitting design documents including a project report.

**Prerequisite:** MARE 451 or MARR 451.**MARE 459 Mechanical Vibrations****Credits 3. 3 Lecture Hours.**

Basic theory of vibrating systems with single and multiple degrees of freedom and principles of transmission and isolation of vibrations.

**Prerequisites:** MARE 206; MARE 261.**MARE 481 Seminar****Credit 1. 1 Other Hour.**

Preparation of Engineering licensure; ethics and professional practice; safety, health, and the environment; review of engineering mathematics, probability and statistics; review of statics, dynamics, strength of materials, fluid mechanics and materials science; review of heat and mass transport processes; review of electricity, power, magnetism, instrumentation and data.

**Prerequisite:** Senior classification.**MARE 484 Undergraduate Internship****Credits 0 to 6. 0 to 6 Other Hours.**

Supervised study with an approved power generator, either electrical, mechanical, or thermal power. Alternatively, studies can be with a research, manufacturing or repair facility whose primary mission is to support power generation. May be taken for credit up to 6 hours.

**Prerequisites:** 2.5 GPR and completion of 300 level courses.

**MARE 485 Directed Studies**

**Credits 1 to 8. 1 to 8 Other Hours.**

Special problems in marine engineering technology not covered by any other course in the curriculum. Work may be in either theory or laboratory.

**Prerequisites:** Approval of department head. Junior or senior classification or approval of instructor.

**MARE 489 Special Topics**

**Credits 1 to 4. 1 to 4 Lecture Hours.**

Selected topics in an identified area of marine engineering technology. May be repeated for credit.

**Prerequisites:** Junior or senior classification or approval of instructor.

**MARE 491 Research in Marine Engineering Technology**

**Credits 1 to 4. 1 to 4 Other Hours.**

Research in Engineering Technology. Research conducted under the direction of faculty member in Marine Engineering Technology. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded.

**Prerequisites:** Junior or senior classification and approval of instructor.