MARE - MARINE ENGR TECHNOLOGY (MARE)

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 102 Engine Room Resource Management

Credit 1. 2 Lab Hours. Marine engineering watch standing and operations; safety and security; effective resource management and control of engine room equipment; leadership and managerial skills.

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.

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 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 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 291 Research

Credits 0 to 3. 0 to 3 Other Hours. Research conducted under the direction of faculty member in marine engineering technology. May be taken two times for credit. Please see an academic advisor in the department. **Prerequisites:** Freshman or sophomore classification; approval of instructor and department head.

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. **Prerequisites:** Grade of C or better in MARE 100, MARE 200, and MART 103; junior or senior classification or approval of MARR and MART department heads.

MARE 301 Digital Fundamentals for Marine Engineers

Credits 3. 2 Lecture Hours. 3 Lab Hours. Marine digital systems and applications including logic and devices that enable these applications throughout many industries; fundamentals and basic concepts of number systems, Boolean algebra, logic gates, combinatorial and sequential logic design, and digital electronics; examination of modern digital devices used for computing, automation, system monitoring, and control. **Prerequisites:** Grade of C or better in MARE 207, ECEN 215, or ESET 210, or concurrent enrollment; 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. 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. Junior or senior classification or approval of instructor. **Prerequisites:** CHEM 107; grade of C or better in MARE 202.

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 316 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 325 Shipboard Networking Systems

Credits 3. 2 Lecture Hours. 3 Lab Hours. Design, operation, application and management of shipboard LANs and WANs; topologies, protocols, bridges, routers, hubs, switches, security; media and transport systems; Internet and TCP/IP topics including the protocol stack, router and bridge operation and addressing issues pertinent to shipboard systems. **Prerequisite:** Grade of C or better in MARE 301.

MARE 327 Data Science for Marine Cybersecurity

Credits 3. 2 Lecture Hours. 3 Lab Hours. Examination of cybersecurity fundamentals and the concept of network security; analysis of the cybersecurity conditions in the maritime domain and the countermeasures deployed against these cyberattacks by using data science tools; survey of data science programming and approaches adopted in the cybersecurity domain to eliminate malware and perform network traffic analysis; development and utilization of data analytic tools for assessing the cybersecurity risks of the maritime sector. **Prerequisites:** Sophomore classification.

MARE 335 Power Electronics for Shipboard Applications

Credits 3. 2 Lecture Hours. 3 Lab Hours. Power electronics design principles and applications in the marine environment; DC/DC converter theory and electrical inverter/converter concept of operation, design, and applications in dynamic shipboard operations and system control; rectification of utility input concepts. **Prerequisite:** MARE 207 or ESET 210 or ECEN 215 with a grade of C or better.

MARE 345 High Voltage Technology for Marine Engineers

Credits 3. 2 Lecture Hours. 3 Lab Hours. Study of High Voltage (HV) electrical systems which includes construction and operating parameters; HV generation, start-up procedures, maintenance and testing; electrical safety of HV equipment; protective relaying in HV systems; electrostatic field and breakdown strength in dielectrics and design consideration of HV equipment; response and control of overvoltage and surges in HV systems to include operator safety and system protective devices. **Prerequisite:** Grade of C or better in MARE 207 or ECEN 215 or ESET 210.

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 377 Engineering Risk Management in Maritime Construction and Shipbuilding

Credits 3. 3 Lecture Hours. Identification, classification, assessment and prioritization of risks in a maritime maintenance, repair or new build project; evaluation and determination of project risk using modern modeling techniques; knowledge and skill required to construct and justify the project management risk register; examination of project resources; diverse project team synthesis, development, management and leadership as a means of risk avoidance. **Prerequisites:** MARE 100 or MARR 101; MARE 209 and MATH 150; or approval of instructor.

MARE 396 Nuclear Engineering for Marine Engineers

Credits 3. 3 Lecture Hours. Analysis and design of nuclear power plants and their marine applications, nuclear physics, plant operations including startup/shutdown and criticality, subsystems, applications, costs, efficiency and cycles, and radiation health; modular design advancements, reactor safety, and case studies applicable to marine propulsion. **Prerequisites:** Grade of C or better in MARE 211, CHEM 107, and PHYS 207; junior or senior classification, or approval of advisor.

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. **Prerequisites:** Grade of C or better in MARE 100, MARE 200, MART 103, and MARE 300 or MARE 350, or equivalents; junior or senior classification or approval of MARR and MART department heads.

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 410 Marine Engine, Energy, and Electrical Resource Management

Credits 3. 2 Lecture Hours. 3 Lab Hours. Advanced level Engine room Watchkeeping; includes the integration of Engine room and personnel Management (ERM), Management of Electronic and Electrical Systems (MEECES), Leadership and Managerial Skills (LMS), and Shipboard Energy Efficiency Planning (SEEMP); knowledge and understanding of the complexities of watchstanding directly impact the ability of a seafarer to operate a safe and efficient marine propulsion plant; training required under the International Convention on the Standards for Training and Certification of Watchkeepers, using simulator-based teaching techniques. **Prerequisites:** Grade of C or better in MARE 200, MARE 211, and MARE 312.

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 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 445 Marine Navigation Systems

Credits 3. 2 Lecture Hours. 3 Lab Hours. Overview of Shipboard Navigation system components, electronics and electrical diagrams; examination of the fundamentals and basic concepts of communication systems such as Global Maritime Distress Safety System (GMDSS), Single Sideband Radio (SSB), and Emergency Position-Indicating Radio Beacon (EPIRBs), positioning systems such as Global Positioning Systems (GPS), hyperbolic long range radio navigation (Loran-C) and chart plotters; topics include radar, auto-pilot systems, and the design, maintenance and troubleshooting of the Shipboard Navigation Station and its power supplies both alternating current (AC) and direct current (DC). **Prerequisites:** Grade of C or better in MARE 235 and MARE 325.

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, MARE 309 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 467 Applied Marine Liquefied Gas Systems for Marine Engineers

Credits 3. 2 Lecture Hours. 2 Lab Hours. Theory, regulations and operation of modern engineering shipboard plants and shoreside facilities which are using dual and tri-fuel engines to generate power. Fuels include Liquefied Gas (LG), Liquid Fuels, Marine Gas Oil and Heavy Fuel Oil. The course will present varying engine operational characteristics. LG safety and risk assessments. The development of Floating Storage Regasification Units (FSRUs). The economic and environmental impact of tri-fuel vessels. **Prerequisites:** Grade of C or better in MARE 100 or MARR 101; grade of C or better in MARE 202 or concurrent enrollment.

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 482 License Preparation Seminar

Credit 1. 1 Other Hour. Preparation for United States Coast Guard (USCG) 3rd Assistant Engineer examination; review of marine engineering safety; review of motor plants; overview of steam plants; review of electricity and electrical control systems; review of refrigeration systems and general subjects. **Prerequisites:** Senior classification; enrollment in marine engineering technology license option program.

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.