

**FY2015-2017 EDUCATIONAL SKILLS REQUIREMENTS  
 NAVAL/MECHANICAL ENGINEERING-ENERGY  
 5603P  
 563**

1. Curriculum Number: 563
2. Curriculum taught at NPS
3. Students are Fully Funded
4. Curriculum Length in Months: 24
5. Months the program starts: January, June
6. APC Required: 323
7. Community Managers have agreed to allow billets to be coded for Naval Mechanical Engineering-Energy 563 and Officers to be educated for this curriculum.

<u>Designator</u>	<u>Officer Community Manager</u>
a. 1110	Surface
b. 1120	Submarine
c. 1440	Engineering Duty

8. The Officer must understand the fundamental concepts and be familiar with the basic functional areas of Mechanical Engineering within the Department of the Navy and the Department of Defense including:

**ESR-1: THERMODYNAMICS AND HEAT TRANSFER:** Fundamentals of thermodynamics and heat transfer with applications to all marine engineering power cycles as well as propulsion and auxiliary system cycle analysis and design.

<b>Required Course #</b>	<b>Description</b>	<b>Alternate Course</b>
ME2101	Thermodynamics (4-1)	Undergraduate
ME3150	Heat Transfer (4-1)	NU3159
ME3240	Marine Power and Propulsion (4-2)	

**ESR-2: FLUID MECHANICS:** Compressible and incompressible flow, both viscous and inviscid, with emphasis on propellers, cavitation, and design of shipboard fluid systems (e.g., fluid machinery, pumps, turbo machinery).

Required Course #	Description	Alternate Course
ME2201	Introduction to Fluid Dynamics (3-2)	Undergraduate
ME3201	Intermediate Fluid Dynamics (3-2)	

**ESR-3: DYNAMICS, CONTROL, NAVIGATION, AND AUTONOMOUS SYSTEMS:** Kinematics and dynamics of particle, rigid-body and multi-body mechanical systems. Modeling and simulation of engineering systems with mechanical, electrical and hydraulic components. Feedback control concepts, both frequency response and time domain, with applications to the design of component, platform, and weapon systems. Control of systems with continuous, discrete and combined logic states. Navigation and control for single and network-centric systems. Design of intelligent systems for machinery monitoring and automation, as well as autonomous vehicle operations.

Required Course #	Description	Alternate Course
ME2502	Dynamics (4-1)	Undergraduate
ME2801	Introduction to Engineering System Dynamics (3-2)	EC2300
ME3801	Linear Automatic Controls (3-2)	

**ESR-4: STRUCTURAL MECHANICS AND VIBRATION:** Statically determinant and indeterminate structural analysis, stress/strain analysis, buckling and fatigue. Shock and vibration response of marine structures, including surface ships and submarines.

Required Course #	Description	Alternate Course
ME2501	Statics (3-0)	Undergraduate
ME2601	Solid Mechanics I (3-2)	Undergraduate
ME3521	Mechanical Vibrations (3-2)	
ME3611	Solid Mechanics II (4-1)	

**ESR-5: MATERIALS AND FABRICATION:** Metallurgical processes and transformations; analytical approach to failure of materials in Naval Engineering use and a basic understanding of the materials technology associated with welding or marine corrosion; an introduction to the developing fields of composites and superconducting materials.

Required Course #	Description	Alternate Course
MS2201	Engineering Materials (3-2)	Undergraduate
MS3202	Failure Analysis and Prevention(3-2)	
MS3304	Corrosion and Marine Environment Degradation (3-2)	MS3606

**ESR-6: COMPUTERS:** A basic understanding of computer system architecture, operating systems, networking and introduction to engineering software design. Practical experience of structured programming languages and the use of integrated design tools for computational and symbolic manipulation. Use and application of mainframe, workstation and personal computers for the solution of Naval engineering design and analysis tasks. Exposure to finite element and finite difference tools and techniques, with application to the thermo-fluid and structural mechanics/dynamics areas, including experience with representative software packages.

Required Course #	Description	Alternate Course
AE2440	Matlab (3-2)	
ME3450	Computational Methods in Mechanical Engineering (3-2)	
MA3232	Numerical Methods for PDE (3-2)	

**ESR-7: MATHEMATICS:** A basic understanding of statistics, multi-variable and vector calculus, matrix and linear algebra, differential equations, partial differential equations, and numerical methods and their applications in mechanical engineering fields of study.

Required Course #	Description	Alternate Course
MA1115	Multi-variable Calculus (4-0)	Undergraduate
MA1116	Vector Calculus(4-0)	Undergraduate
MA2043	Introduction to Linear and Matrix Algebra (4-0)	Undergraduate
MA2121	Differential Equations (4-0)	Undergraduate

MA3132	Partial Differential Equations (4-0)	
MA3232	Numerical Methods for PDE (3-2)	

**ESR-8: DESIGN/SYNTHESIS:** Design synthesis and introduction to optimization techniques, with emphasis on the design of mechanical subsystems and their integration into the ship system.

Required Course #	Description	Alternate Course
ME3711	Design of Machine Elements (4-1)	
ME3712	Capstone Design Project (1-6)	Undergraduate Design Project

**ESR-9: ELECTRICAL ENGINEERING:** Electromagnetic and circuit theories, dc circuits, steady-state ac circuits, methods of circuit analysis, including Laplace transforms. Exposure to the construction and operating characteristics of rotating machinery, static converters, and power distribution systems and multi-phased circuits.

Required Course #	Description	Alternate Course
EO2102	Introduction to Circuit and Power System Analysis (4-2)	Undergraduate TS3000 NU3009

**ESR-10: NAVAL ARCHITECTURE:** Fundamentals of naval architecture including the geometry, hydrostatics and hydrodynamics of monohull floating and submerged structures. Wave and skin friction analysis, power requirements of particular designs. Longitudinal and transverse stability of floating and submerged bodies, hull girder strength requirements. Introduction to sea keeping and survivability principles.

Required Course #	Description	Alternate Course
TS3001	Fundamental Principles in Naval Architecture (3-2)	Undergraduate

**ESR-11: SPECIALIZATION:** Each officer will also acquire technical competence in ENERGY through additional graduate level courses and their associated prerequisites.

Required Course #	Description	Alternate Course
ME4XXX	Energy Specialization Elective	
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	Elective	
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For energy specialization the following classes will be taken in addition to agreed-upon specialization courses selected for Thesis work in the area of Energy:

Required Course #	Description	Alternate Course
PH3700	Fundamentals of Energy (4-0)	Undergraduate
OS3007	Operations Research for Energy Systems Analysts (4-0)	
EN3000	Defense Energy Seminar (2-0)	

**ESR-12: THESIS:** The graduate will demonstrate the ability to conduct independent analysis, in the area of Naval/Mechanical Engineering-Energy and proficiency in presenting the results in writing and orally by means of a thesis and command-oriented briefing appropriate to this curriculum.

Required Course #	Description	Alternate Course
ME0810	Thesis Research (0-8)	
ME0810	Thesis Research (0-8)	
ME0810	Thesis Research (0-8)	
ME0810	Thesis Research (0-8)	

Approved: *1*

[Redacted Signature]

[Redacted Name] Director, Chief of Naval Operations  
Energy and Environmental Readiness Division (OPNAV N45)

[Redacted Signature]

[Redacted Name] President, Naval Postgraduate School

[Redacted Signature]

[Redacted Name] Director, TFMTER, (OPNAV N12)

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Date

2 March 2016

Date

4 April 2016

Date