EDUCATIONAL SKILL REQUIREMENTS
For NAVAL/MECHANICAL ENGINEERING
CURRICULUM (570)
Subspecialty Code 56xxP

Officers entering into the Naval/Mechanical Engineering curriculum will be offered the necessary preparatory level courses to enable them to satisfy the equivalent of a baccalaureate degree in Mechanical Engineering. They shall meet, as a minimum, the requirements set forth by the Accreditation Board for Engineering and Technology (ABET). At the graduate level, the officer will acquire the competence to participate in technical aspects of naval systems research, design, development, maintenance and acquisition. The background to deal with future advances is gained through the emphasis on design and a combination of the core program requirements, specialization and thesis research. In pursuit of the above, the goal is for each officer to acquire a senior/upper division level physical and analytical understanding of the following topics. It is recognized that all students may not meet all ESRs depending on individual circumstances determined by the curricular officer and the academic associate. However, each student will be exposed to fundamentals in all ESR areas.

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.

ME2101 THERMODYNAMICS (4-1)
ME3150 HEAT TRANSFER (4-1)
ME3240 MARINE POWER AND PROPULSION (4-2)

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, turbomachinery).

ME2201 INTRODUCTION TO FLUID DYNAMICS (3-2)
ME3201 INTERMEDIATE FLUID DYNAMICS (3-2)

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.

ME2502 DYNAMICS (4-1)
ME2801 INTRODUCTION TO ENGINEERING SYSTEM DYNAMICS (3-2)
ME3801 LINEAR AUTOMATIC CONTROLS (3-2)

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.

ME2501 STATICS (3-0)
ME2601 SOLID MECHANICS I (3-2)
ME3521 MECHANICAL VIBRATIONS (3-2)
ME3611 SOLID MECHANICS II (4-0)

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 and marine corrosion; an introduction to the developing fields of composites and superconducting materials.

MS2201 ENGINEERING MATERIALS (3-2)
MS3202 FAILURE ANALYSIS AND PREVENTION (3-2)
MS3304 CORROSION AND MARINE ENV. DEGRADATION (3-2)
MS3606 INTRODUCTION TO WELDING & JOINING METALLURGY (3-2)

6. COMPUTERS: A basic understanding of computer system architecture, operating systems (such as UNIX), networking and introduction to engineering software design. Practical experience of structured programming languages (such as FORTRAN, C), and the use of integrated design tools for computational and symbolic manipulation (such as MATLAB and Maple). 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 of representative software packages.

EC1010 MATLAB (1-1)
ME3450 COMPUTATIONAL METHODS IN MECH. ENG. (3-2)
MA3232 NUMERICAL METHODS FOR PDE (3-2)

7. MATHEMATICS: Sufficient mathematics, including integral transforms and numerical analysis, to achieve the desired graduate education.

MA1115 MULTI-VARIABLE CALCULUS (4-0)
MA1116 VECTOR CALCULUS (4-0)
MA2043 INTRODUCTION to LINEAR AND MATRIX ALGEBRA (4-0)
MA2121 DIFFERENTIAL EQUATIONS (4-0)
MA3132 PARTIAL DIFFERENTIAL EQUATIONS (4-0)
MA3232 NUMERICAL METHODS FOR PDE (3-2)
OS3104 STATISTICS FOR SCIENCE AND ENGINEERING (4-0)

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.

ME3711 DESIGN OF MACHINE ELEMENTS (4-1)
ME3712 CAPSTONE DESIGN PROJECT(1-6)

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 multiphased circuits.

EO2102 INTRODUCTION TO CIRCUIT AND POWER SYSTEM ANALYSIS (4-2)

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 seakeeping and survivability principles.

TS3001 FUNDAMENTAL PRINCIPLES IN NAVAL ARCHITECTURE (3-2)

11. SPECIALIZATION: Each officer will also acquire technical competence in one or more of the following areas: THERMAL/FLUID SCIENCES, SOLID AND STRUCTURAL MECHANICS, DYNAMICS AND CONTROLS, MATERIAL SCIENCE, OR TOTAL SHIP SYSTEMS ENGINEERING through additional graduate level courses and their associated prerequisites.

Three (3) ME4XXX COURSES (minimum of 12 quarter hours)

12. JOINT AND MARITIME STRATEGIC PLANNING: American and world military history and joint and maritime planning including the origins and evolution of national and allied strategy; current American and allied military strategies which address the entire spectrum of conflict; the U.S. maritime component of national military strategy; the organizational structure of the U.S. defense establishment; the role of the commanders of unified and specified commands in strategic planning, the process of strategic planning; joint and service doctrine, and the roles and missions of each in meeting national strategy.

NW3230 STRATEGY AND POLICY: THE AMERICAN EXPERIENCE (4-2)

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

Four (4) ME0810 Thesis slots (equivalent of 16 quarter hours)

Curriculum Sponsor and ESR Approval Authority

_____ _____

Kevin M. McCoy Date
Rear Admiral, United States Navy
Chief Engineer, Naval Sea Systems Command

_____ _____

VADM (ret) Dan Oliver Date
President, Naval Postgraduate School

_____ _____

Director, Total Force Programming and Manpower Management Date
OPNAV N12