

2024-27 EDUCATIONAL SKILL REQUIREMENTS  
Naval Nuclear Engineering  
Subspecialty 520xP

Curriculum Number: 520

Curriculum taught at: Massachusetts Institute of Technology

Students are Fully Funded

Curriculum Length: 24 Months

APC Required: n/a

The Engineering Duty Officer Community Manager has agreed to allow billets to be coded for Naval Nuclear Engineering Subspecialty 520xP and officers to be educated for this curriculum.

Mr. John Keegan  
Engineering Duty Officer Plans and Governance  
(NAVSEA 00T)  
Approval date: 15 May 2024

**1. Physics:** Principles of atomic and nuclear physics. Interaction of radiation and matter.

**2. Nuclear Engineering:** Principles of nuclear reactor design. Reactor theory, including fission reactor physics, heat generation, heat transfer, fluid flow, fuel design and critical safety margins as the basis of reactor plant design with emphasis on pressurized water reactors and reactor safeguards and their application to steam propulsion plants.

**3. Automated Controls System:** In depth analytical and physical understanding of control system theory, methods and applications with emphasis on nuclear power plant instrumentation and control.

**4. Radiological Science and Technology:** Detailed knowledge of the effects of radiation on the environment with emphasis on protection, measurement, detection and monitoring. Knowledge of government directives associated with nuclear waste management. Knowledge of OSHA requirements. Understanding of shielding and shielding design principles.

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**5. Reliability and Safety:** Basic understanding of the theory and applications of probabilistic concepts for engineers including a detailed understanding of the reliability, maintainability, and availability concepts as applied to ship power generation systems up to and including fault tree analysis.

**6. Mathematics:** Mathematics sufficient to support the scope of the technical program and to include linear algebra, differential equations, vector calculus, integral transforms, and system analysis.

**7. Cybersecurity:** Understand and apply the fundamentals of the underlying principles of cyber infrastructure and systems; inherent vulnerabilities and threats, including industrial control systems; and defensive security procedures.

**8. Naval Architecture:** Principles of naval architecture include ship geometry, hydrostatics, stability, hull structure strength, resistance and powering.

**9. Power and Propulsion:** Comparison of the problems and economics of alternative ship power generation systems; diesel, gas turbine, combined diesel and gas turbine, and fossil fuel versus nuclear power. First and Second Laws of thermodynamics, heat transfer, propulsors, analysis of shipboard engineering cycles including saturated steam plant technology.

**10. Materials and Fabrication, Chemistry and Corrosion Control:** Knowledge of materials and fabrication methods used in power plant and nuclear reactor technology. Knowledge of effects of pressurized water reactor environment on materials. Understanding water chemistry control processes as applicable: (1) to nuclear plant corrosion and ion exchange processes, (2) to steam generator (or boiler) corrosion processes, and (3) power plant piping system corrosion processes. Understanding environmental control processes as applicable to the corrosion of materials in general.

**11. Advanced Technical Option:** Advanced theoretical subjects to form a basis for specialization in one area related to Nuclear Engineering.

**12. Thesis:** Demonstrate the ability to conduct independent research and analysis and proficiency in presenting the results in writing and orally by means of a thesis related to reactor design, physics, control, thermal hydraulics, materials, safety,

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maintenance, reliability, fuel or other reactor plant related topic.

APPROVED: Casey/Motom RAMM USN  
Curriculum Sponsor

04 JUN 2024  
[DATE]

APPROVED: Jack Grigg  
Director, OPNAV N71

07 Aug 2024  
[DATE]

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