

**NCEES Principles and Practice of Engineering Examination  
 NAVAL ARCHITECTURE AND MARINE ENGINEERING Exam Specifications**

**Effective Beginning with the April 2016 Examinations**

- The exam is an 8-hour open-book exam. It contains 40 multiple-choice questions in the 4-hour morning session, and 40 multiple-choice questions in the 4-hour afternoon session. Examinee works all questions.
- The exam uses both the International System of units (SI) and the US Customary System (USCS).
- The exam is developed with questions that will require a variety of approaches and methodologies, including design, analysis, and application.
- The knowledge areas specified as examples of kinds of knowledge are not exclusive or exhaustive categories.

		<b>Approximate Number of Questions</b>
<b>I. Naval Architecture</b>		<b>30</b>
A. Hydrostatics and Stability		10
1. Tools, methods, and procedures (e.g., Bonjean curves, curves of form, integration methods, inclining, sallying)		
2. Intact stability (e.g., center of gravity, righting arm, free-surface, weight shifts, docking, grounding)		
3. Damage stability (e.g., floodable length, probabilistic stability, righting arm, down flooding, impact of list, free communication)		
4. Dynamic stability (e.g., impact on stability caused by wind and waves, towing, parametric roll, porpoising, broaching, chine walking, green water)		
5. Transitional stability (e.g., submerged to surface, displacement to planing, hull borne to foil borne, semi-submersible)		
B. Hydrodynamics		8
1. Resistance and propulsion (e.g., different hull forms, shallow water effects, ice, channel blockage)		
2. Propulsor, foil, and appendage design including cavitation		
3. Maneuvering and directional stability (e.g., steering, rudders, control surfaces)		
4. Seakeeping (e.g., forces and motions, added mass, wave damping, response amplitude operators, motion stabilization)		
5. Station keeping (e.g., anchoring, dynamic positioning, mooring)		
6. Model testing (e.g., scaling laws)		
C. Ocean Engineering		2
1. Wind, waves, and currents (e.g., wave theories, wave spectra, tides, wind scale, sea state)		
2. Mooring systems (e.g., floating structure to sea bed, berthing, anchoring)		

D.	Structural Design	10
1.	Internal loads (e.g., sloshing, tank loading, hydrostatic loads)	
2.	External loads (e.g., slamming, impact, berthing, collision, drydocking, grounding, mooring, launching, ice, wind, waves)	
3.	Primary structures (e.g., hull girder, midship section)	
4.	Secondary structures (e.g., frames, beams, girders, trusses, plates, columns, pillars, foundation)	
5.	Tertiary structures (e.g., clips, brackets, knees, gussets)	
6.	Structural considerations (e.g., stress concentration, fatigue, corrosion, thermal variations)	
7.	Analytical tools (e.g., finite element analysis [FEA], buckling analysis, boundary element methods)	
8.	Hull responses and reactions (e.g., vibration, impulse, whipping, springing, slamming)	
9.	Material selection (e.g., ferrous materials, non-ferrous materials, composites, plastics, wood, concrete)	
II.	<b>Marine Engineering</b>	<b>30</b>
A.	Piping System Design	7
1.	Component selection (e.g., valves and control devices, strainers, filters, pumps)	
2.	Design considerations (e.g., viscosity, limiting flow speeds, flow effects, noise, cavitation, pipe hammer, pressure)	
3.	Layout (e.g., piping support, arrangement, maintenance)	
4.	Calculations (e.g., pipe flow, pipe resistance, pressure drop, stress analysis)	
B.	Propulsion and Power Generation	10
1.	Internal combustion plants	
2.	Gas turbine plants	
3.	Fuels and lubrication (e.g., properties, handling systems, effects on equipment, choices of fuels and lubricants)	
4.	Drive train (e.g., propulsors, gearing, shafting, bearings)	
5.	Auxiliary systems (e.g., fuel systems, exhaust systems, starting systems)	
6.	Drive train vibration (e.g., flow induced, machinery induced, shafting)	
C.	Auxiliary Equipment Selection	5
1.	Heat exchangers	
2.	Pumps and compressors	
3.	Habitability support (e.g., auxiliary boiler, potable water, galley equipment)	
4.	Environmental protection (e.g., oily water separation, sewage treatment, solid waste, ballast water treatment)	
D.	HVAC/Refrigeration	3
1.	Design considerations (e.g., limiting flow speeds, flow effects, noise, pressure, air turnover, temperature, filtration, insulation, indoor air quality)	
2.	Layout (e.g., ducting support, piping support, arrangement, maintenance)	
3.	Calculations (e.g., flow, air balance, pressure drop, heat balance)	
E.	Electrical Systems	5
1.	Component selection (e.g., generators, transformers, motors, batteries, switch gear, cables)	
2.	Design considerations (e.g., power load, overload, redundancy, power factor, emergency generator requirements, bonding, safety)	
3.	Calculations (e.g., electrical load analysis, cable sizing, voltage drop, power conversion)	

<b>III. Common</b>	<b>20</b>
A. Corrosion	3
1. Elements of corrosion (e.g., galvanic series, general wastage, pitting, crevice and stress corrosion, fretting, stray currents)	
2. Corrosion-control applications (e.g., impressed current systems, sacrificial anodes, bonding and grounding, coating selection and procedures)	
B. Hull Outfitting	4
1. Deck machinery (e.g., winches, anchoring and mooring equipment, gangways)	
2. Cargo handling (e.g., closed loading/unloading systems, cargo pumps, cranes, ramps, hatches, containers, inert gas and vapor recovery)	
3. Steering and maneuvering systems (e.g., thrusters, rudders)	
4. Fittings (e.g., bollards, bitts, chocks, rigging)	
5. Cargo securing and safety (e.g., container, liquid, break bulk, bulk)	
C. Accommodation Outfitting	2
1. Fire protection (e.g., structural, personnel, fire detection, fire zone definitions, egress, firefighting equipment)	
2. Arrangements and details (e.g., joiner work, workflow, access, equipment location, emergency evacuation)	
D. Shipbuilding and Repair	2
1. Non-destructive testing (e.g., dye-penetrant, magnetic particle, ultrasonic, radiographic)	
2. Dock and sea trials	
E. Welds and Connections	4
1. Connectors and fasteners (e.g., rivets, bolts, adhesives) and bimetallic joints (e.g., explosion bonding)	
2. Welding design and procedures (e.g., stresses, symbols, filler materials, methods, inspection, testing)	
F. Rules and Regulations	5
1. Statutory requirements (e.g., U.S. Coast Guard, IMO, OSHA, EPA, ADA, REACH [Registration Evaluator Authorization and Restriction of Chemicals], IECEX, ATEX)	
2. Admeasurement and international conventions and agreements (e.g., STCW, MARPOL, SOLAS)	
3. Construction, design, and inspection standards (e.g., classification societies, ABYC, ASTM, NFPA, MCA, IEEE, AWS, API, Panama Canal Regulations)	