

**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<br/>Number of<br/>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)   |  |  |

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| 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)  |           |

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| <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)             |           |