Naval Architecture and Offshore Structures

Design and Construction of Offshore Power Systems
Academic Year 2025/2026

1. Describe typical hazards encountered in water transport.
2. Explain the ALARP risk criterion.
3. List the stages of a safety assessment (FSA).
4. Discuss the selected method for assessing the probability of human error.
5. Define reliability from a probabilistic perspective.
6. Conduct a risk analysis of a selected technical object.
7. Project risk management.
8. Sea current profiles – approximating functions.
9. Regular waves – sketch, symbols, equation and wave properties.
10. Irregular waves – sketch, symbols and equation.
11. Particle trajectories in waves (deep water, intermediate depth, shallow water).
12. Wave spectrum – approximations and parameters influencing the spectrum shape.
13. Wind – stationary models (wind profile), functions and parameters.
14. Applied wind spectrum functions and non-stationary wind speed model.
15. Modeling the impact of a waved sea on a cylindrical structure.
16. Random event and probability of a random event.
17. Random variables and examples of distributions.
18. Statistical inference – point and interval estimation.
19. Definition and classification of stochastic processes.
20. Conditions for the existence of an extremum of a multivariable function.
21. Method of undetermined Lagrange multipliers.
22. Interpolation using the Lagrange polynomial.
23. Interpolation using splines.
24. Materials used in the construction of floating and offshore engineering structures.
25. Shaping the structure and properties of metals and alloys using technological methods.
26. Wear mechanisms of structural materials.
27. Discuss methods for identifying and avoiding resonant motions of floating structures during the design phase.
28. The importance of seagoing vessels in the global transport system.
29. Equipment of container and bulk cargo terminals.
30. Intermodal transport – advantages and disadvantages.

The list below is intended to cover the key technical content of the specialisation in a structured and exam-oriented form.

31. How is lift, drag and aerodynamic torque determined for an aerofoil on the basis of C_L, C_D and C_M characteristics as functions of angle of attack?
32. How can the physical mechanism of lift generation be explained, including the Kutta–Joukowski theorem and circulation concept?
33. How is lift generated on a finite-span wing, and what is the engineering meaning of trailing vortices and induced drag?
34. What are the assumptions, derivation steps and limitations of the one-dimensional momentum theory for an ideal wind turbine, including the Betz limit?
35. How are the power coefficient C_P, thrust coefficient C_T and tip-speed ratio (TSR, λ) defined, and how are they used to describe wind turbine performance?
36. How does the Blade Element Momentum (BEM) method work in steady flow, and what are its main assumptions and engineering limitations?
37. How do yaw misalignment, unsteady inflow and turbine rotation influence the aerodynamic loading of a wind turbine rotor?
38. How can the velocity field and the boundary-layer flow around a wind turbine blade section be described and interpreted?
39. How are wake formation, wake expansion and wake recovery behind an offshore wind turbine explained from the aerodynamic point of view?
40. What methods can be used to control or deflect the wake of a wind turbine, and what are the expected gains and trade-offs at wind farm level?
41. What is the blockage effect in a wind farm, and how does it influence power production and flow conditions within the farm?
42. What are the main types of offshore wind support structures, and for what water depths and operating conditions are they applied?
43. How can the basic hydrodynamic and hydrostatic loads acting on offshore support structures be characterized?
44. What are the six rigid-body motions of a floating offshore structure, and why are they important for design and operation?
45. What are the basic types of mooring and anchoring systems for floating offshore wind structures, and what functions do they fulfil?
46. What similarity laws are used in model tests of offshore structures, and what are the main scaling problems in offshore wind experiments?

47. How can the dynamics of substructures fixed to the seabed be described, and what is the role of soil–structure interaction in such systems?
48. How are the mechanical characteristics of beam cross-sections used in the analysis of bending in offshore and wind turbine structures?
49. How are internal forces, stresses and deflections determined in a cantilever beam subjected to bending loads?
50. How are closed thin-walled beam sections characterized in torsion, and how is the angle of twist determined?
51. What is the stiffness matrix of a structural element, and how is the matrix-stiffness approach used in structural modelling?
52. How can the dynamics of one-degree-of-freedom and multi-degree-of-freedom systems be formulated and interpreted in the context of wind turbine and offshore structure vibrations?
53. What is aeroelasticity in wind turbines, and how do aerodynamic, inertial and elastic effects interact in rotor blades and support structures?
54. What are the main mechanisms of fatigue and durability degradation in wind turbine blades, towers and offshore support structures?
55. How should wind be modelled for offshore wind engineering purposes, including stationary and non-stationary descriptions, turbulence and wind spectra?
56. How are wind turbine control systems structured, and what are the roles of supervisory, pitch, torque and yaw control loops?
57. How is a wind turbine represented as an object of control, including its aerodynamic, mechanical and electrical subsystems?
58. How are control strategies selected for below-rated and above-rated wind speeds, including MPPT, power limitation and load reduction?
59. What measurement methods are used in offshore wind and marine power systems, including standard uncertainty types A and B as well as remote wind measurements such as SODAR and LIDAR?
60. How are offshore wind farm installation, operation and maintenance processes planned, including transport, port infrastructure, vessel support and logistics constraints?