GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2024-2025

Ship Manoeuvring and Seakeeping Behaviour of Floating Structures (E055060)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0 **Study time 180 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)	English	Gent	practical	0.0h
			excursion	0.0h
			lecture	0.0h

Lecturers in academic year 2024-2025

Delefortrie, Guillaume	TW15	lecturer-in-charge

Offered in the following programmes in 2024-2025	crdts	offering
Bridging Programme Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	6	A
Master of Science in Electromechanical Engineering(main subject Maritime Engineering)	6	A
International Master of Science in Advanced Design of Sustainable Ships and Offshore Structures	6	A

Teaching languages

English

Keywords

waves, response of floating and sailing structures in (ir)regular waves, steering, manoeuvring

Position of the course

Theoretical background and practical approach of the behaviour of floating and sailing structures as a result of (ir)regular waves and internally or externally induced horizontal forces.

Contents

- Gravity waves:
  - Irrotational wave motion: linear theory
  - Irregular waves, energy spectrum
- Response of floating structures in regular waves:
  - Introduction to radiation and diffraction problem for floating, stationary objects
  - Pitch, heave and roll motions of ships
- Response of floating structures in irregular waves:
  - Response spectrum
  - Statistical considerations
  - Applications
- Introduction to wave force determination on floating and fixed structures by means of potential flow theory
- Behaviour of ships in the horizontal plane:
  - Directional stability and manoeuvrability
  - Forces acting on a manoeuvring ship hull
  - Control devices
  - External forces
  - Automatic course control
  - Unmanned navigation
- Optionally: a guest lecture on an actual topic, examples: manoeuvring in waves, autonomous ships,...

Initial competences

This course builds on some learning outcomes of the course Marine Hydrostatics and Stability

Final competences

1 Be capable of explaining the physical phenomena on which the motion response of a ship or another floating structure due to regular waves is based. Be capable of composing the mathematical representation of the heave, pitch and roll response of a ship to regular waves by means of linear wave theory and strip theory.
2 Describe and apply the characteristics and properties of an irregular seaway by means of (directional) wave spectra.
3 Derive, interprete and apply the mathematical formulation of the response spectrum of a ship or floating structure on an irregular sea. Calculate exceedance probabilities for undesired effects (slamming, shipping of water, ...).
4 Acquire insight into the non-linear aspects of the roll motion of ships. Explain the physical and mathematical background and describe the practical realisation of technical solutions for reducing the roll motion of ships.
5 Be able to apply seakeeping software for determining the response characteristics of ships or other floating structures to regular waves and for calculating exceedance probabilities for undesired effects in irregular seas.
6 Gain insight into the use of potential flow theory to determine the wave induced forces on floating and fixed structures.
7 Gain insight into the manoeuvring and steering behaviour of ships by means of linear theory. Explain and analyse the efffect of the principal parameters determining the manoeuvring and steering behaviour of ships.
8 Explain and interprete the execution and results of standard manoeuvres.
9 Be able to explain the physical background and derive the mathematical formulation of the main hydrodynamic coefficients of the linear equations of motion for sway and yaw.
10 Be able to explain the physical background and the mathematical formulation of the hydrodynamic forces acting on a rudder. Distinguish the main types and realisations of rudders and other steering equipment for ships and their application ranges.
11 Be able to derive and interprete the mathematical background of autopilots for ships.
12 Gain insight into the mathematical modelling of a ship's manoeuvring behaviour for simulation purposes.
13 Determine the main rudder characteristics in a concept design phase.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Excursion, Lecture, Practical, Independent work

Study material

Type: Syllabus

Name: Ship manoeuvring and seakeeping: lecture notes
Indicative price: € 25
Optional: no
Language : English
Number of Pages : 500
Oldest Usable Edition : 2024
Available on Ufora : No
Online Available : No
Available in the Library : No
Available through Student Association : Yes

Type: Slides

Name: Ship manoeuvring and seakeeping: slides
Indicative price: Free or paid by faculty
Optional: no

Language : English
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No

References

Course content-related study coaching

Lecturer and assistant are available before and after the lectures. Additional contacts are possible after appointment or by e-mail

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment, Written assessment open-book

Examination methods in case of periodic assessment during the second examination period

Oral assessment, Written assessment open-book

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

During examination period:
- oral closed-book exam on theory, written preparation
- written open-book exam on exercises.

During semester: graded project reports. No assistance is provided during the second examination period.

Calculation of the examination mark

Oral closed-book exam during examination period: 50%
Written open-book exam during examination period: 25%
Project reports during semester: 25%.
The student can only pass for the entire course if:
- for each of the above mentioned items a mark of at least 5 on 20 is obtained
- for two of the above mentioned items a mark of at least 10 on 20 is obtained

If the above conditions are not met the final mark is the minimum of 9/20 and the above mentioned weighted result.