

## 2<sup>ND</sup> TERM EXAM - SHIP DYNAMICS / MEC-E2004

Modules: Seakeeping methods, Wave Loads, Seakeeping Criteria and model tests, Added Resistance, Maneuvering

**Time: 30.05.2022, 11:00-14:00 hrs., Virtual exam, Open Book**

**Answers in English only.** Clear writing and use of the right terminology is required. Answers should be provided below each question. At the end of the exam save your file as **surname\_student number.pdf** and email it to XXXXXXXXXX

### 1. Seakeeping methods – general principles

- a. Which are the two key methods used for linear seakeeping analysis? Discuss the principles of these key methods. **1.5p**
- b. What are the basic assumptions of the perfectly linear seakeeping problem? **1.5p**
- c. Discuss in terms of advantages and limitations what are the differences between linear and nonlinear theories? When the use of nonlinear theories for seakeeping calculations would be preferable? **2p**

### 2. Wave loads (global and local)

- a. Name the basic classes of local and global wave loads. Highlight the role of hydroelasticity **1p**
- b. Define hogging and sagging. Discuss the role of the loading instruments and hull condition monitoring systems. **1p**
- c. Write Newton's Equation of motion for hydroelasticity. Summarize in tabular format the basic 2D and 3D linear hydroelastic modelling methods for global load assessment. **1p**
- d. Discuss the basic principles and physical meaning of the  $1/20^{\text{th}}$  and  $L/\lambda$  Rules **2p**.

### 3. Seakeeping criteria

- a. What is motion sickness? Explain three measures of ship performance in terms of seakeeping criteria. **2p**
- b. Why seakeeping tests are carried out? Briefly describe typical model test set ups and considerations for (a) free seakeeping models (b) horizontally restricted seakeeping models (c) hydroelastic models **2p**
- c. What is the relevance of seakeeping in terms of shipping operations? **1p**

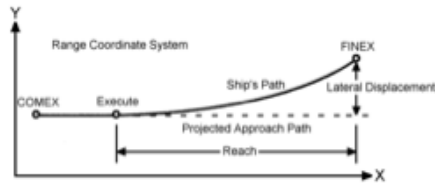
### 4. Added Resistance and Maneuvering

- a. What motion component(s) mainly cause the added resistance of the ship? **1p**

- b. Name two ways we can typically use to assess ship resistance in waves. What are the advantages and limitations of these methods? **2p**
- c. What are the requirements that make the ship motion stable? Define Controllability and Motion Stability. **2p**

**5. Bonus Question**

- a. What test is presented in enclosed figure? What causes the lateral displacement? **2p**



- b. Name the six degrees of freedom representing the motions of a ship in waves. Define added mass and damping. Draw the roll, heave and sway RAO of added mass and damping for a typical box like ship section (**2p**)
- c. How are operational effectiveness and voluntary speed loss connected by definition? **1p**