Aalto University
School of Engineering

MEC-E1004 Principles of Naval Architecture

"2nd mid term" and "Final" exam revision

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Rules of engagement

Exam - rules of engagement

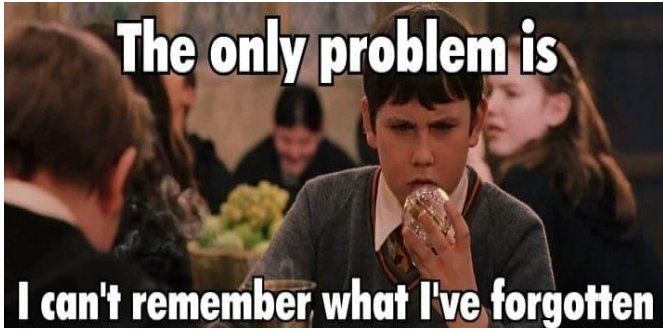
- **Type :** Open book exam
- **What you may do :** You may use the web, calculators, computer codes, etc. You will have to use the *.xls sheets you have been using for your assignments

Exam - rules of engagement

- **Two paper options !!**
  - ✓ *2nd mid term exam paper :* 4 questions corresponding to lectures 6 – 10 + one bonus question
  - ✓ *Final exam paper :* 4 questions corresponding to lectures 1 – 10 + one bonus question

- **NB**
  - ✓ *If you scored a lower to your expectations mark in 1st mid term exam you may wish to take the final exam paper. In this case the result from your 1st mid term exam will be ignored and 50% of your total final mark will be based on final exam paper.*
  - ✓ *If you did not participate in the 1st mid term exam you have to take the final exam paper and accordingly 50% of your PNA mark will be based on this score*
  - ✓ *If you scored to your satisfaction in the 1st mid term exam you can simply take the 2nd mid term exam. In this case each assessment will count for 25% of your final PNA mark.*

How to Revise



- ❑ Eat/drink well and refrain from panicking
- ❑ Wake up 30 mins earlier than usual
- ❑ Revise by simulating the same environment you will work under
- ❑ Seek for past papers from LRK and use the mid term exam as past paper
- ❑ Read your lecture notes and highlight. You do not need to memorize.
- ❑ Gather your thoughts / concentrate on exam tips I will give at class

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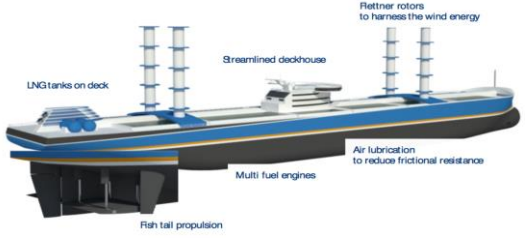
Academic highlights for your benefit

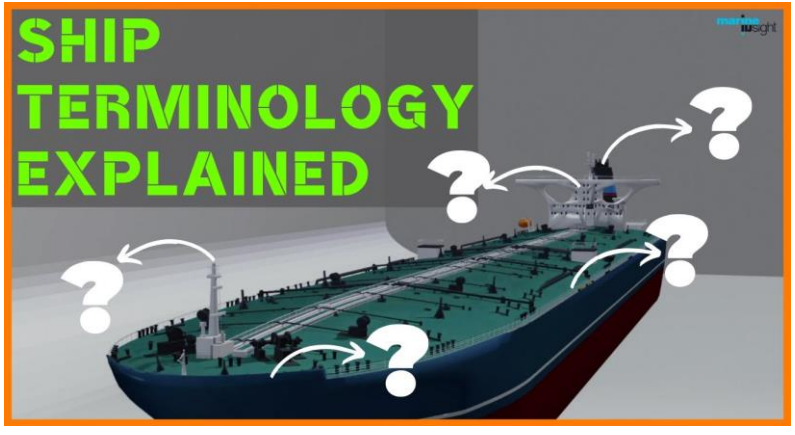
The Ship Design context

- Design **parameters, variables and constraints**
  - ✓ *How do they relate with your ship design ?*
- **The role of Rules and Regulations**
- **Shipping sustainability and green technologies**
- **The stages of design and the design spiral**
- **The role of the IMO, national administrations (e.g., HELCOM) regulators, class societies and the importance of design innovation**



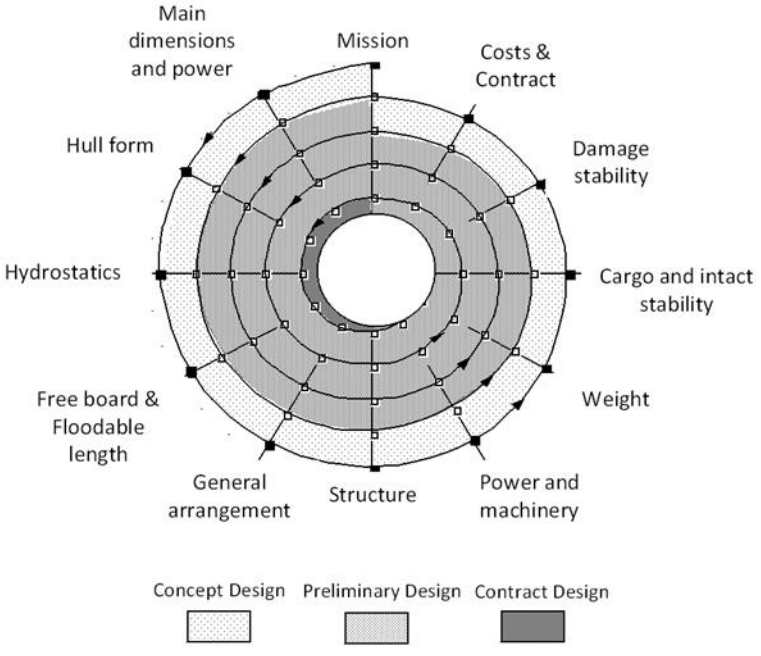
Ship terminology

- Different principles of categorizing a ship. Be able to categorize the ship you design in your group project
- Explain what is a reference ships and the use of reference ship data
- Terminology !!! (Speed, weight, tonnage, displacement, flags of convenience, form coefficients, general particulars)
- Evaluation and calibration of ship general particulars



Ship design stages and coefficients

- How do we define the stages in design and the design spiral ?
- List and define terminology related to a ship's main dimensions
- What are the approaches to determine a ship's main dimensions
- What it means if a ship's capacity is (a) limited by weight, (b) limited by volume.
- Evaluation of ship design features using coefficients of form and main dimensions ?



Ship main dimensions

- *A shipowner has a fleet of bulkers. He requested from your firm to support them with a new tanker which has a 10% increase in the DWT in comparison to their last design. The fleet is very old, some weight data estimates are missing. The length of the dock at which the ship will be built limits the length to 200 meters. The maximum breadth to draught ratio (B/T) required is estimated based on the formula B/T = 9.625 - (7.5× C_B). The main characteristics of the reference ship are : L = 200 m, B = 30 m, T = 14m, Cb = 0.82, DWT = 60,000 tonne. If Cb remains constant, calculate the displacement and the main characteristics of the new design using both Normand's number approach and the statistical design method.*

Ship main dimensions

- ***(1)*** *You may use Norman's no excel spreadsheet to evaluate the deadweight of the new ship. Then consider what happens when the ship draft is increased while the block coefficient is kept the same. This will led to new dimensions and B/T ratio.*
- ***(2)*** *The use of statistical design method is based on Table 3.3 of course booklet. You may use the band given under tankers classification and the then use the main dimension *.xls spreadsheet to evaluate the ship main characteristics.*

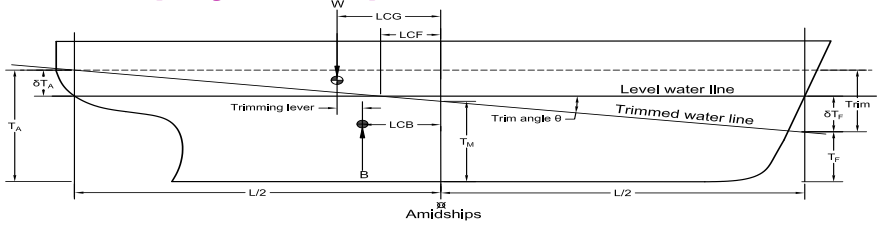
Ship dimensions and GA

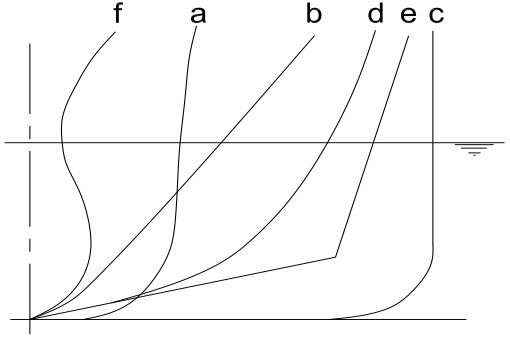
A. *A box barge is 400 m long and 60 m wide. She floats at a draught of 14 m in a a lake. Calculate the barge displacement at the North sea, the Baltic sea and in fresh water.*

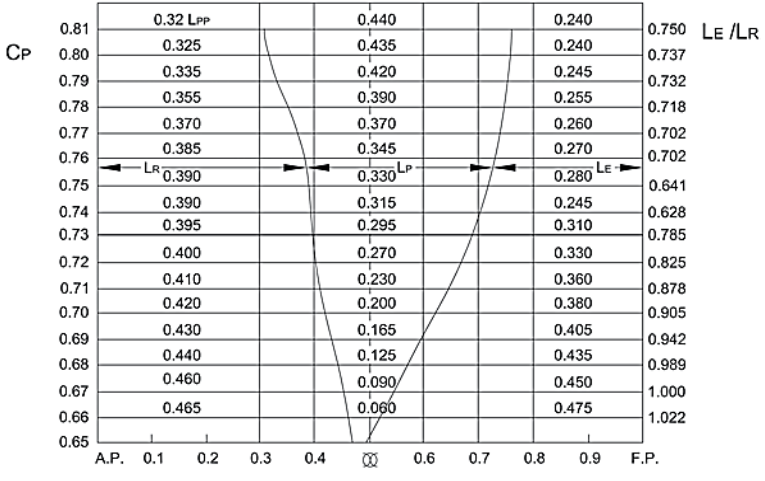
B. *A passenger ship has 30 m breadth, volumetric displacement* $\nabla = 31500\, m^3$ *and operates at speed 15 knots. Use Ayre's formula to estimate the ship length and then calculate the block coefficient using Schneekluth formula.*

Hull form development

- **Basic hull form related terminology**
- **The factors that need to be considered when determining the form of a ship's hull**
- **Relationships between form factors to hydrodynamics**
- **How did you apply the above knowledge to shape your ship's hull**

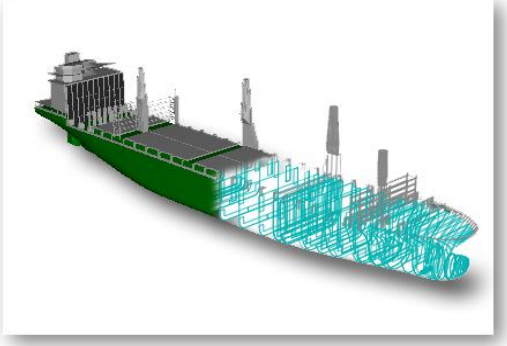






Ship Hydrostatics

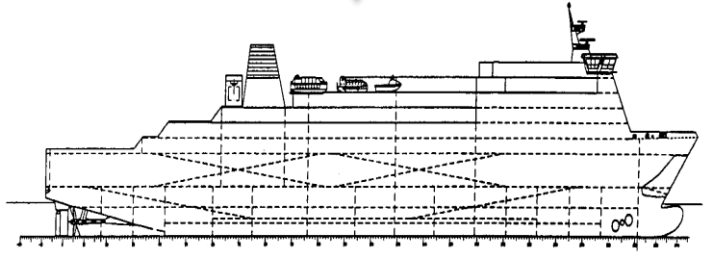
- What is hydrostatics and why they are important in ship design?
- Numerical Integration methods
- Explain and apply basic hydrostatic formulas and methods (Simpson integration xls for 1st and 2nd rules)
- Apply Simpsons Rules as per numerical examples shown in the course booklet

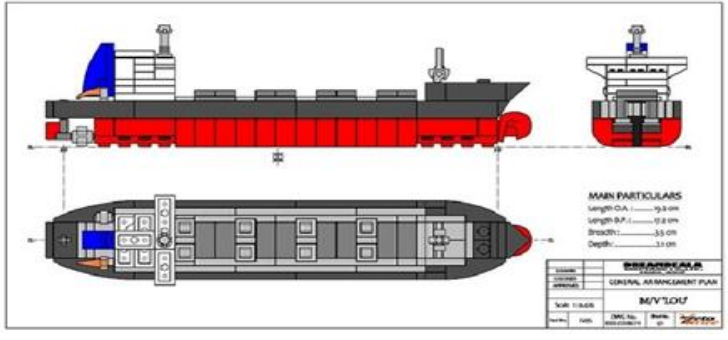


Ship General Arrangement

- **No unified rules – experience matters !!**
- **Can you conceptualise and clarify the different steps of developing a GA?**
- **Various GA examples but how this knowledge relates with your ship design project ?**
- **How the specific demands of a segment or technology can impact the choices in the GA ?**

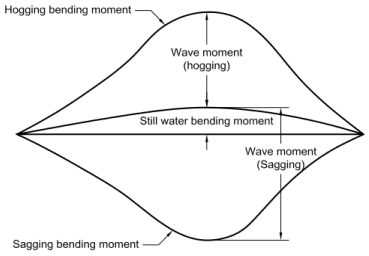
Advantages and limitations
(consider new fuel installation)



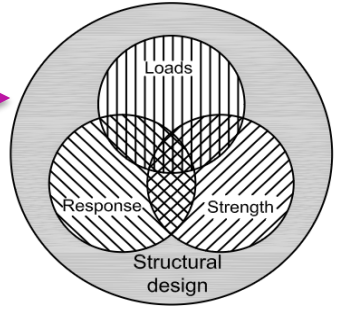


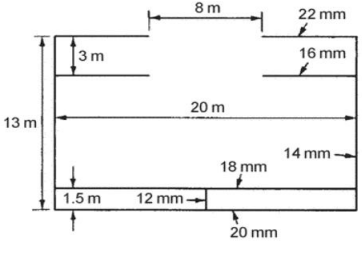
Ship structures

- Describe the ship structural design framework
- Basic classification of loads
- Section modulus – concentrate on using the spreadsheet available to evaluate the section modulus
- Basic materials and design procedures



Conceptualization

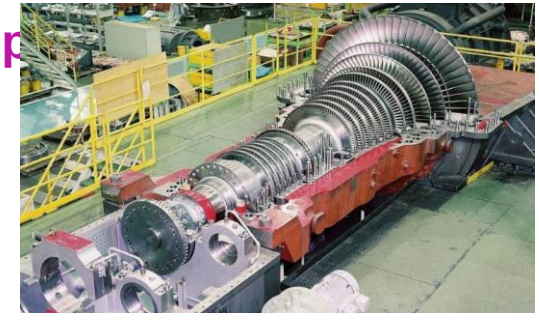


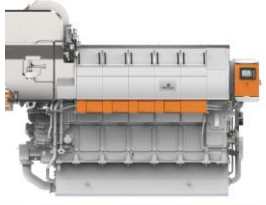


Cause and effects

Ship powering

- **The importance of ship operational profile for ship design**
- **Basic engine and auxiliary system types and propulsion systems : name advantages and limitations with focus on design choices**
  - ***Characteristics of propulsion systems (e.g. diesel electric)***
- **Basic principles of ship resistance**
- **Terminology of equipment and components**





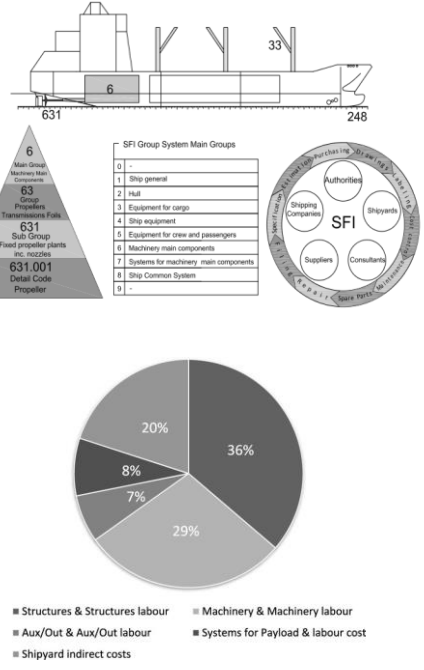
Ship weights & economics

- **The SFI system**
  - ***key characteristics and means of implementation***

- **Preliminary weight calculations**
  - *What are weight reserves ?*
  - *How weight calcs and reserves are managed in the shipbuilding process?*

- **Economic KPIs for ship operations (concentrate on NPV and RFR)**
  - *Assume a ship can move 10 million tons of cargo over a given trade route over 2 years. Its cost is 60 M USD and life 20 years. Annual operating costs are 5 M USD. The owner assumes yield of 10%. What is the RFR?*
  - *A 30 M USD investment on a ship gives biannual returns of 160 M USD over 40 years. What is the NPV ? Assume 10% interest.*

- **Shipbuilding costs (modularisation, subcontracting, technology)**
  - *Which costs belong to each category ?*
  - *How outfitting affects the price of a ship ?*
  - *Why technology is important ?*
  - *Why modularisation is important ?*



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Thank you !

Mid term revision