COURSE INFORMATION

Instructor:	Dr. Jasmin Jelovica	**Term/period:**	Term 1
Email:	jjelovica@mech.ubc.ca	**Class meeting times:**	Wed 12-1.30, Fri 11.30-13
Office:	CEME 2208E	**Office hours:**	Anytime, agree by email

COURSE DESCRIPTION

Structural efficiency and general dimensioning principles; longitudinal bending and torsion of thin-walled structures; introduction to classification society rules; buckling of bars, plates and shells; ultimate strength of composite sections; introduction to fatigue of ship structures; ship section design synthesis.

LEARNING OUTCOMES

Upon completion of the course, it is expected that students will be able to:

- Describe the structural components of a ship and the structural properties of those components;
- Apply basic hull girder analysis for the design of a ship structure, including calculations of vertical global hull girder bending loads, section modulus, and bending stresses;
- Apply basic concepts of shear stresses in ship primary and tertiary structures, including shear flow and shear lag effects;
- Apply basic concepts for the bending of beams, plates, and stiffened panels as applied to a ship structure;
- Apply basic concepts for the buckling of columns, plates, and stiffened panels as applied to a ship structure;
- Calculate fatigue life of simplified structural details under constant and variable amplitude loading;
- Assess potential failure modes of the structural components of a ship, and be able to predict the onset of such failures.

ASSESSMENT SUMMARY

Assignments	40%
Exam, part 1	30%
Exam, part 2	30%
Total	**100%**

Criteria to pass the course: 50% of each assignment and each exam. Students pursuing MEng, MEL, MASc and PhD degrees need to secure 60% (of each part) in order to satisfy their program requirements.

Only non-programmable calculators are permitted in the exams. Cell phones and laptops should be turned off during the exams. Dates of the exams to be agreed.

SUBMISSION OF ASSIGNMENTS

It is very important that your calculations can easily be reviewed by another engineer, and so a significant portion of your marks for all the assignments in the course will be based on neatness and clarity of calculations, therefore:

- Follow IMRAD report structure.
- Present the main deliverables and important results first and leave details for appendix.
- Make sure your calculations and explanations are professionally organized and easy to follow.
- Make sure your name and student number appear on all pages.

- Submit your assignments in pdf to course website and on time according to the due date specified. Late assignments will lose a percentage of the assignment mark: every day of delay - 10%.
- Following instructor's feedback, submit revised reports with modified text shown in red

COURSE MATERIALS

There is no required textbook for the course, although the closest book that covers majority of topics is Hughes & Paik (2010) "Ship Structural Analysis and Design" published by SNAME. It is available in pdf from UBC library. The class notes will also be posted on course website. Students should take notes in the class as not everything is available in the notes.

TOPICS

General dimensioning principles:

- Components of ship structures
- Framing types and application circumstances
- Sigma 1-2-3

Longitudinal bending and torsion of thin-walled structures:

- Vertical bending moment and shear force distribution
- Torsion of composite thin-walled sections
- Bending of beams and plates with application to ship structures
- Shear lag in wide sections

Classification societies' rules:

- Design logic
- Mechanics of materials as basis for the practical rules
- Use in the assignment

Ultimate strength of hull girder:

- Buckling of bars, plates and shells
- Influence of manufacturing imperfections
- Progressive failure of composite complex cross-sections

Fatigue of metallic structures:

- Nature of the fatigue phenomena
- Constant- and variable-amplitude loading
- Reality vs. laboratory environment
- S-N approach, strain-life approach, cyclic material properties

Ship section design synthesis:

- Combining stresses from different topology levels
- Simplifications in design and associated uncertainties
- Design moment vs. ultimate bending moment

Finite element method:

- The use of the approach in various analysis types and stages of ship design is presented throughout the course

SUGGESTED REFERENCES

- Hughes & Paik (2010) “Ship Structural Analysis and Design” Published by the Society of Naval Architects and Marine Engineers.
- Mansour & Liu (2008) “The Principles of Naval Architecture Series: Strength of Ships and Ocean Structures” Published by the Society of Naval Architects and Marine Engineers.
- Paik & Thayamballi (2007) “Ship-Shaped Offshore Installations. Design, Building and Operation” Published by Cambridge University Press.
- Bai (2003) “Marine Structural Design” Published by Elsevier.