SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos” University of Galați
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Research & Design Internship 2**						
2.2 Lecture organizer	**-**						
2.3 Internship organizer							
2.4 Year of study	**I**	2.5 Semester	II	2.6 Type of assessment	**V**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	12	where: 3.2 lecture	-	3.3 internship	12
3.4 Total hours in the curriculum	168	where: 3.5 lecture	-	3.6 internship	168
Time distribution					hours
Study after manuals, syllabuses, bibliography and notes					10
Further documentation in libraries, on specialized electronic platforms and fieldwork					10
Preparing assignments, portfolios					12
Tutorials					10
Examinations					4
Other activities:					-

3.7 Total hours of individual study	46
3.9 Total hours per semester	214
3. 10 Number of credits	8

4. Prerequisites (where relevant)

4.1 curriculum related	• Disciplines from the bachelor's degree in Naval Architecture / Mechanical Engineering. • Full assisted disciplines from the Naval Architecture Master.
4.2 competence related	• Define, analyze, and use appropriate research and design systems.

5. Conditions (where relevant)

5.1. of the lecture	• -
5.2. of the internship	• Experimental and numerical laboratories within the Research Center "Naval Architecture", experimental equipment, computers, software, Internet access, bibliographic sources. • Research and design laboratories at partner internship companies.

6. Specific competences acquired	
Professional competences	**C2 Hydrodynamic optimization of the hull forms – 2 credits** **C3 Propulsion system design – 1 credit** **C4 Advanced design of ship structures – 1 credit** **C5 In-depth knowledge and development of materials and technologies used in the field of shipbuilding – 1 credit**
Transversal competences	**CT1 Fulfilment in due time of the design and/or the research activities in naval architecture – 1 credit** **CT2 Efficient conduct of co-ordination of the design and/or the research activities in naval architecture – 1 credit** **CT3 Assessment of the need for professional training, in the context of the evolution of the field – 1 credit**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C2.1 Detailing the methods, techniques and procedures for describing the concepts related to the hull forms optimization. C2.2 Explaining and sensing the applied hydrodynamics knowledge to the particular problem of a ship hull regardless of its geometry. C3.1 Description of the propulsion systems and of the technical vocabulary specific to the domain of naval architecture. C3.2 Efficient use of the acquired knowledge for explaining and interpreting the propulsion system working regimes. C4.1 Defining and specifying methods, techniques and procedures for describing concepts specific to the advanced design of ship structures. C4.2 Classification and use of methods, techniques and procedures for analyzing concepts specific to advanced design of new ship structures. C5.1 In-depth knowledge, analysis and synthesis of naval technologies. C5.2 Use of information sources and specialized knowledge for the analysis, evaluation and selection of technological solutions imposed in new situations. CT1 Fulfilment in due time of the design and/or the research activities in naval architecture CT2 Efficient conduct of co-ordination of the design and/or the research activities in naval architecture CT3 Assessment of the need for professional training, in the context of the evolution of the field
7.2 Specific aims	C2.3 Complete use of the conceptual and methodologic apparatus to solve specific hydrodynamics problems related to the optimal design of the hull forms. C2.4 Applying criteria and evaluation methods with which the hull forms can be improved. C2.5 Argumentation by models and projects of the most appropriate methods for defining the optimal forms from a hydrodynamic point of view. C3.3 Identifying adequate methods, techniques, and procedures for the design of the propulsion systems under the incomplete documentation condition. C3.4 Data analysis to formulate value judgments and substantiate constructive decisions specific to propulsion systems design. C3.5 Conduct studies that use innovatory a wide range of quantitative methods specific to propulsion systems design. C4.3 Apply the appropriate methods and techniques for the advanced design of ship structures under incomplete information to solve new theoretical problems. C4.4 Evaluate and interpret data specific to the advanced design of ship structures to substantiate constructive decisions. C4.5 Making models and designing projects that use innovative qualitative and quantitative methods specific to the advanced ship structures design. Developing projects using concepts specific to the advanced design of ship structures. C5.3 Integrated use of the information, conceptual and methodological apparatus in the development of innovative technologies. C5.4 Applying algorithms to assess the performance of new technologies to improve decision making. C5.5 Innovative use of specific technologies for the purpose of project development.

8. Contents

8.1 Lecture	Teaching method	Observations Number of hours
8.2 Internship	Teaching method	Observations Number of hours
1. Analysis and selection of the theoretical methods of study applicable in the field of the research theme	Research and design	168 hours
2. Analysis and selection of the technological research methods applicable in the field of research		
3. Analysis and selection of experimental modeling methods applicable in the field of investigation of the research topic		
4. Analysis of numerical investigation capabilities at "Dunărea de Jos" University of Galati, in the field of research		
5. Analysis of the technological investigation capabilities at "Dunărea de Jos" University of Galati, in the field of research		
6. Analysis of experimental investigation capabilities at "Dunărea de Jos" University of Galati, in the field of research		
7. Research-design internship report		

Bibliography

1. Amoraritei, M., ”Complements of Marine Propellers Hydrodynamics in Non-uniform Flow”, Galati Univ. Press, 2008
2. Andersson, B., Andersson, R., Hakansson, L., Mortensen, M., Sudiyo, R., van Wachem, B., ”Computational Fluid Dynamics for Engineers”, Cambridge University Press, 2012
3. Betram, V., “Practical Ship Hydrodynamics”, (Ed.II) Butterworth Heinemann, Oxford, 2012
4. Babicz, J., “Wärtsilä Encyclopedia of Ship Technology“, Wärtsilä Corporation, Second Edition, Helsinki, 2015
5. Breslin, J.,P., ”Hydrodynamics of Ship Propeller”, Cambridge University Press, 2003
6. BV, „Rules for Classification and Construction”, Bureau Veritas, 2023
7. Carlton, J., S., ”Marine Propellers and Propulsion”, Elsevier, 2006
8. Domnisoru, L., “Structural Analysis and Hydroelasticity of Ships”, The „Dunărea de Jos” University Foundation Publishing House, Galati, 2006
9. Domnisoru, L., Lungu, A., Dragomir, D., Ioan, A., „Complements of Structural Analysis and Ship Hydrodynamics”, Galati University Press, 2008
10. DNV-GL., “Rules for Classification and Construction”, Det Norske Veritas & Germanischer Lloyd, 2023
11. Dragomir, D., Lungu, A., Domnisoru, L., „Naval Architecture Design Complements”, „Didactic and Pedagogic” Publising House, Bucharest, 2007
12. Eyres, D.J., „Ship Construction”, Elsevier Butterworth-Heinemann, New York, 2007
13. Ferziger, J.H., Peric, M., ”Computational Methods for Fluid Dynamics”, Springer-Verlag, Third Edition, 2002
14. Ghose, J., P., Gokarn, R., P., ”Basic Ship Propulsion”, New Delhi, 2004
15. Hadar, A., „Multilayer Composite Materials”, Academy and AGIR Publishing House, Bucharest, 2002
16. Hadar,A., Marin,C., Petre,C., Voicu,A., " Numerical Methods in Engineering ", Politehnica Press, Bucharest, 2005
17. Hirsch, C., ” Numerical Computation of Internal and External Flows: The Fundamentals of Computational Fluid Dynamics”, Butterworth-Heinemann, 2007
18. ISO 6954:2000, "Mechanical vibration — Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships", https://www.iso.org/obp/ui/#iso:std:iso:6954:ed-2:v1:en
19. ISO 20283-5:2016, "Mechanical vibration — Measurement of vibration on ships — Part 5: Guidelines for measurement, evaluation and reporting of vibration with regard to habitability on passenger and merchant ships", https://www.iso.org/ obp/ui/#iso:std:iso:20283:-5:ed-1:v1:en
20. Lewandowski, E.M., „The Dynamics of Marine Craft”, World Scientific, New Jersey, 2004
21. LR, “Ship Vibration and Noise. Guidance Notes”, Lloyd's Register, London, 2023
22. Lungu, A., (Ed) “Numerical Modeling in Engineering”, Academica Press, Galati, 2001
23. Mandal, N.R., ” Ship Construction and Welding”, Springer Nature Singapore Pte Ltd., 2017
24. Mansour, A., Liu, D., „Strength of Ships and Ocean Structures, The Principles of Naval Architecture Series, SNAME, New Jersey, 2008
25. Mocanu, C., "Strength of Materials", „Dunărea de Jos” University Foundation Publishing House, Galati, 2005

26. Obreja, D., “ Ship theory. Concepts and Methods of Navigation Performance Analysis”, „Didactic and Pedagogic” Publishing House, Bucharest, 2005
27. Okumoto, Y., Takeda, Y., Mano, M., Okada, T., “Design of Ship Hull Structures - A Practical Guide for Engineers”, Springer-Verlag, 2009
28. Paik, J.K., Thayamballi, A.K., „Ship Shaped Offshore Installations”, Cambridge University Press, 2007
29. Rao, S.S., “The Finite Element Method in Engineering”, Elsevier Science & Technology Books,, New York, 2004
30. Rawson, K.J., Tupper E.C., „Basic Ship Theory”, (2 vol) Butterworth Heinemann, Oxford, 2001
31. Rodolfo, A., White, J., “Dynamic Scheduling with Microsoft Project”, International Institute for Learning, 2011
32. Serban, D., Gavan, E., “Shipbuilding and Welding Technology”, Evrika Publishing House, Brăila, 2001
33. Spyridon, E.H., Chunhua, Ge, “Review & Introduction to Hydroelasticity of Ships”, Lloyd’s Register, London , 2005
34. Stoicescu, L., "Strength of Materials", Evrika Publishing House, Braila, 2 vol., 2004
35. Storch, R.L., Hammon, C.P., Bunch, H.M. & Moore, R.C., “Ship production”, Cornell Maritime Press, 2000
36. Schull, P.J., “Nondestructive Evaluation - Theory, Techniques, and Applications”, Marcel Dekker, New York, 2001
37. Versteeg, H., Malalasekera, W., ”An Introduction to Computational Fluid Dynamics: The Finite Volume Method”, Prentice Hall, 2007
38. Vlase, S. , „Composite Materials. Numerical Methods , “Transilvania” University Publishing House, Braşov, 2007
39. Vorus, W.S., „Vibration”, The Principles of Naval Architectures Series, SNAME, New Jersey, 2010
40. Zienkiewicz, O.C., Taylor, R.L.,”The Finite Element Method” (3 Vol.), Elsevier Butterworth-Heinemann, Oxford, 2000

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

The training includes the basic elements for integrating the graduate in the activities of the shipbuilding research and design companies, as well as for Bologna III PhD studies.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	---	---	---
10.5 Internship	Applying specialized knowledge in research and design activities	- Evaluating the weekly research-design internship that quantifies the rhythmic involvement and accuracy of the results. - Evaluation of the research-design internship report.	70% 30%
10.6 Minimum performance standard (Each evaluation part is marked in the standard reference system 1-10.)			
- The student should pass the current activities in the research and design internship. - The student should pass with the grade 5 the examination of the research-design internship report.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunarea de Jos" University of Galati
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Project Management**						
2.2 Lecture organizer							
2.3 Project organizer							
2.4 Year of study	**I**	2.5 Semester	I	2.6 Type of assessment	**E+P**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	3	where: 3.2 lecture	1	3.3 project	2
3.4 Total hours in the curriculum	42	where: 3.5 lecture	14	3.6 project	28
Time distribution					hours
Study after manuals, syllabuses, bibliography and notes					6
Further documentation in libraries, on specialized electronic platforms and fieldwork					4
Preparing seminars / labs, assignments, essays, portfolios and essays					6
Tutorials					4
Examinations					2
Other activities					2

3.7 Total hours of individual study	24
3.9 Total hours per semester	66
3. 10 Number of credits	2+2

4. Prior learning / Prerequisites (where relevant)

4.1 curriculum-related	• Management notions
4.2 competence-related	• Not applicable

5. Conditions (where relevant)

5.1. of the lecture	• Classroom, laptop, video projector
5.2. of the project	• Laptop, video projector

6. Specific competences acquired

Professional competences	• **Not applicable**
Transversal competences	• **CT1 Fulfilment of design and/or research activities in the field of the naval architecture - 1 credit** • **CT2 Efficient and effective deployment of the Naval Architecture design and / or research coordination activities - 2 credits** • **CT3 Self-assessment of the need for professional training, in the context of the evolution of the field - 1 credit**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	In-depth knowledge and use of project management concepts
7.2 Specific aims	Develop a project theme based on the stages of project management.

8. Contents

8. 1 Lecture	Teaching method	Observations
Cap.1 Introduction in the Project Management 1.1 Defining Project Management 1.2 The project life cycle 1.3. Defining the Project Management Process Initiating Planning Executing Controlling Closing 1.3.1Project planning Create a project plan Create a resource plan Create a risk plan 1.3.2. Project execution Build the deliverables Monitor and control Time Management Cost management Quality management Change management Risk management Procurement management Communications management 1.3.3. Project closure	Lecture, explanation, problem, debate, critical thinking development	2 hours
Cap.2 Project Management Processes 2.1 Identifying the Initiating Processes 2.1.1 Identifying Needs 2.1.2 Creating a Feasibility Study Identifying the Business Needs		2 hours

Creating a Product Description Creating a Project Charter Selecting the Project Management 2.2 Identifying the Planning Processes Creating a Scope Statement Recruiting the Project Team Creating the Work Breakdown Structure Completing the Initial Risk Assessment Creating the Network Diagram Completing Estimates Discovering the Critical Path Creating the Project Schedule Completing the Project Budget Completing Risk Assessment Completing Risk Response Planning 2.3 Executing Processes Authorizing the Project Work Dispersing Project Information Ensuring Team Development 2.4 Controlling Processes Leading Configuration Management Managing Cost Control Monitoring Risk Response		
Cap.3 Implementing Project Integration Management 3.1 Developing the Project Plan Applying Tools and Techniques for Project Plan Development Adopting a Project Plan Methodology Earned Value Management (EVM) Evaluating the Outputs of Project Plan Development Examining the Typical Project Plan Project Charter Project Management Approach Project Scope Statement Work Breakdown Structure Plan Details Project Schedule Risk Management Plan Outputs from Planning 3.2 Executing the Project Plan Evaluating the Project Plan Execution Inputs Implementing Tools and Techniques for Project Execution		2 hours
Cap.4 Project Time Management 4.1 Defining the Project Activities Decomposing the Project Work Packages Compiling the Activity List 4.2 Updating the Work Breakdown Structure 4.3 Creating Network Diagrams Using the Precedence Diagramming Method Using the Arrow Diagramming Method Using a Project Network Diagram Updating the Activity Lists Estimating Activity Durations Developing the Project Schedule Considering the Resource Requirements		2 hours

Evaluating the Project Constraints Using Resource Leveling Heuristics Controlling the Project Schedule 4.4 Using a Project Management Software for GANTT and network diagram of the project		
Cap. 5 Project Risk Management 5.1 Planning for Risk Management Using a Risk Management Plan Template Risk Management Methods Creating the Risk Management Plan Identifying Risks Creating Risk Categories Creating a Probability-Impact Matrix 5.2 Management of the risks Planning for Risk Response Creating Risk Responses Avoiding the Risk Mitigating the Risk Accepting the Risks Implementing Risk Monitoring and Control		2 hours
Cap.6 Project Cost Management 6.1 Identifying Resource Requirements Calculating Resource Rates Estimating Activity Durations 6.2 Cost Estimating Estimating Project Costs Developing the Cost Management Plan Developing the Project Budget Implementing Cost Control Updating the Budget 6.3 Applying Earned Value Management Calculating the CPI Schedule Performance Index Calculating Estimate at Completion EAC		2 hours
Cap.7 Project Human Resource Management 7.1 Completing Organizational Planning Applying Human Resource Practices Planning for Project Human Resource Management 7.2 Creating the Role and Responsibility Assignments 7.3 Creating a Staffing Management Plan Creating an Organizational Chart Managing Staff Acquisitions Recruiting Project Team Members Assembling the Project Team Developing the Project Team Training the Project Team Examining the Results of Team Development		2 hours

Bibliography

1. Roland Gareis-Happy projects, Manz Crossmedia, 1051 Vienna, ISBN 3-214-08268-X, 2005
2. Dennis Lock- Project Management, CODECS Publishing House, 1996
3.Keegan, A.E., Turner J.R., -Managing human resources in the project-based organization, in: Turner, J.R. (ed), People in Project Management, Gower, Aldershot, 2003
4. Rodolfo Ambriz and John White- Dynamic Scheduling with Microsoft Project 2010, Co-Published with International Institute for Learning, Inc., ISBN: 978-1-60427-061-7, 2011
5. Bodea, C.N. Project Management, INFOREC, Bucharest, 2000.
6. Duncan, W: A Guide to the Project Management Body of Knowledge, Project Management Institute, 1996.

8. 2 Project	Teaching method	Observations
Create a project plan Create a resource plan Create a financial feasibility plan	Case studies, situation simulation, group work methods, individual work workshops, critical thinking development methods	2 hours
Calculating the Net Present Value Calculating the Internal Rate of Return Project comparison from a financial point of view		4 hours
Creating the communication plan Creating a communication matrix Reporting the project performance		2 hours
Identify the risks of the project Create a risk plan based on the risk assessment Applying the risk management strategies		2 hours
Create the WBS of the project Establishing the work packages		2 hours
Create the network of the project Create the GANTT chart		2 hours
Monitor and control the project based on Earned value methodology		4 hours
Applying the configuration management		4 hours
Planning for Procurement Completing Procurement Planning Determining the Contract Type Examining the Results of Procurement Planning Creating the Evaluation Criteria Performing Contract Administration Formal closure of the procurement contracts		4 hours
Final report of the project manager		2 hours

Bibliography

1. Roland Gareis-Happy projects, Manz Crossmedia, 1051 Vienna, ISBN 3-214-08268-X, 2005
2. Dennis Lock- Project Management, CODECS Publishing House, 1996
3.Keegan, A.E., Turner J.R., -Managing human resources in the project-based organization, in: Turner, J.R. (ed), People in Project Management, Gower, Aldershot, 2003
4. Rodolfo Ambriz and John White- Dynamic Scheduling with Microsoft Project 2010, Co-Published with International Institute for Learning, Inc., ISBN: 978-1-60427-061-7, 2011
5. Bodea, C.N. Project Management, INFOREC, Bucharest, 2000.
6. Duncan, W: A Guide to the Project Management Body of Knowledge, Project Management Institute, 1996.

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme.

- The discipline contributes to the managerial training of the future shipbuilding specialist.
- It assures the accumulation of knowledge on the use of the managerial techniques and tools used in the shipyards.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	- Understanding and assimilating the fundamental knowledge of the subject	Final exam consisting of: - written test (to evaluate the acquired knowledge); - presentation of the project	90%
	- Developing the necessary knowledge base and intellectual capabilities for analysis, synthesis and comparison, to ensure lately, as a shipbuilding engineer, the possibility of taking correct managerial decisions as well as the ability to objectively assess the results of the completed work	Presence at the project hours, participation in debates, stimulation of the critical thinking	10%
10.5 Seminar/lab	Apply the fundamental knowledge of the discipline	Elaboration of the project	100%
10.6 Minimum performance standard			
• • Elaboration of the project; • • Promoting the final exam with grade 5.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos" University of Galați
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Complements in Propulsion Dynamics**						
2.2 Lecture organizer							
2.3 Project organizer							
2.4 Year of study	**I**	2.5 Semester	I	2.6 Type of assessment	**E**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	4	where: 3.2 lecture	2	3.3 laboratory	2
3.4 Total hours in the curriculum	56	where: 3.5 lecture	28	3.6 laboratory	28

Time distribution	hours
Study after manuals, syllabuses, bibliography and notes	10
Further documentation in libraries, on specialized electronic platforms and fieldwork	6
Preparing seminars / labs, assignments, essays, portfolios and essays	10
Tutorials	2
Examinations	3
Other activities: project	2

3.7 Total hours of individual study	33
3.9 Total hours per semester	89
3. 10 Number of credits	6

4. Prerequisites (where relevant)

4.1 curriculum related	• Ship resistance • Propeller theory
4.2 competence related	• Adapt of general design concepts in naval architecture. • Define, analyze and use appropriate integrated design, calculation and analysis systems.

5. Conditions (where relevant)

5.1. of the lecture	• Classroom, laptop, video projector, whiteboard
5.2. of the project	• Numeric lab, computers, cavitation tunnel, tower tank

6. Specific competences acquired

Professional competences	**C3 Ship propulsion systems design – 6 credits**
Transversal competences	**Not applicable**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C3.1 - Description of ship propulsion systems and technical communication language specific to the naval architecture domain. C3.3 - Identify the methods, techniques and procedures appropriate for designing propulsion systems under incomplete information.
7.2 Specific aims	C3.2 - Use of specialized knowledge in explaining and interpreting the propulsion systems operation in new situations C3.4 - Data analysis to formulate value judgments and substantiate constructive decisions specific to propulsion systems design C3.5 - Conduct studies that use innovatory a wide range of quantitative methods specific to propulsion systems design

8. Contents

8.1 Lecture	Teaching method	Observations Number of hours
1. Ship as a complex system. Ship propulsion systems analysis. Actual trends in ship propulsion.	Lecture, heuristic conversation, explanation, questioning, debate, development of critical thinking	4 hours
2. IMO requirements regarding reduction of GHG emissions from ships. EEDI-Energy Efficiency Design Index. EEDI formula analysis. Solutions to reduce GHG emissions from ships		2 hours
3. Marine propeller. 2D and 3D Geometry. Mathematical Description of propeller geometry related to CAD/CAM systems and CFD applications. Propeller materials. Propeller manufacturing technology.		4 hours
4. Propeller experimental approach. Law of similarity in practice. Hydrodynamic characteristics. Wake measurements, propeller open-water tests, self-propulsion tests and cavitation experimental investigation.		4 hours
5. Propeller theoretical approach. Overview of methods. Momentum theory. Blade element theory. Circulation theories: Lifting-line and Lifting-surface methods. CFD methods: Panel methods and RANS methods.		4 hours
6. Propeller design. Preliminary design (using systematic series chart). Propeller design (using lifting line method with lifting surface corrections). Propeller analysis (study of propeller behaviour in steady and unsteady flow)		4 hours

7. Hydrodynamic performances of marine propeller in unsteady flow. Wake field. Propeller unsteady forces: bearing forces and pressure pulses. Propeller as a source of noise and vibrations. Further devices to avoid noise and vibrations induced by the propeller.		4 hours
8. Unconventional propulsors and devices for improved propulsive efficiency.		2 hours

Bibliography

1. Breslin, J.,P., ”Hydrodynamics of Ship Propeller”, Cambridge University Press, 2003
2. Carlton, J., S., ”Marine Propellers and Propulsion”, Elsevier, 2006
3. Ghose, J., P., Gokarn, R., P., ”Basic Ship Propulsion”, New Delhi, 2004
4. International Maritime Organisation (IMO), <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/>
5. Amoraritei, M., ” Complemente de hidrodinamica elicelor navale in curent neuniform”, Galati University Press, 2008
6. Ceangă, V., Mocanu C., I., Teodorescu, C., Dinamica Sistemelor de propulsie”, Editura Didactică şi Pedagogică, 2003.
7. *** "Marine Engineering", Editor Roy Harrington, Newport News Shipbuilding 1992
8. Bertram, V., "Practical Ship Hydrodynamics“, 2000
9. Sasajima, T., “Usefulness of Quasi-Steady Approach for Estimation of Propeller Bearing Forces Propellers “ SNAME Symposium, Virginia Beach, may 1978
10. Hoshino, T., “Comparative Calculations of Propeller Performance in Steady and Unsteady Flow Using a Surface Panel Method” 22nd ITTC Committee Propeller RANS/Panel Method Workshop, , Grenoble, France, 1998
11. Van Gent, V., “On the Use of Lifting Surface Theory for Moderately and Heavily Loaded Ship Propellers” Publications no.536, NSMB Wageningen,

8. 2 Laboratory	Teaching method	Number of hours
1. EEDI calculation for a given ship	Case studies, explanations, development of critical thinking	2 hours
2. Propeller geometry. Pitch measurement.		2 hours
3. Experimental investigations of marine propeller performances. Law of similarity in practice.		2 hours
4. Experimental investigations of marine propeller performances. Open water propeller tests.		2 hours
5. Hydrodynamic characteristics of marine propeller. Alternative forms of propulsion performances diagrams.		2 hours
6. Self propulsion tests. Hull propeller interaction coefficients. Thrust/torque identity methods.		2 hours
7. Propeller design using systematic series – practical applications using.		8 hours
8. Propeller design using lifting line method with lifting surface correction.		2 hours
9. Propeller as source of noise and vibrations. Unsteady forces induced by the propeller in non-uniform flow.		4 hours
10. Propeller cavitation. Experimental cavitation tests.		2 hours

Bibliography

1. Ghose, J., P., Gokarn, R., P., ”Basic Ship Propulsion”, New Delhi, 2004
2. Breslin, J.,P., ”Hydrodynamics of Ship Propeller”, Cambridge University Press, 2003 (cap.8,14,15,17,22,23)
3. International Maritime Organisation (IMO). 2014. Third IMO GHG Study 2014, Executive Summary and Final Report
4. International Maritime Organisation (IMO), <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/ AirPollution/>
5. Carlton, J., S., ”Marine Propellers and Propulsion”, Elsevier, 2006
6. Dumitrecu, H., Georgescu, A., Ceangă, V., “Calculul elicei”, Editura Academiei Române,1990, (cap.VII).
7. Amoraritei, M., ” Complemente de hidrodinamica elicelor navale in curent neuniform”, Galati University Press, 2008
8. Ceangă, V., Mocanu C., I., Teodorescu, C., “Dinamica Sistemelor de propulsie”, Editura Didactică şi Pedagogică, 2003 (cap.I, II,III,VIII,X).

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

The content of the discipline leads to the acquirement of the necessary competences for the study and design of ship propulsion systems, in order to improve the propulsion performance of the ships. These competences are required by employers in the labour market, both in the country and abroad, involved in the research and design activities in naval architecture.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lectures	- analysis of ship as a complex system to find the best balance of propulsive performance, cargo area, required power, speed, low noise and vibration levels on board; - formation of the basis of reasoning required in the design and research activity for ship propulsion system.	Written final exam at which the student has to answer to 4-5 theoretical questions and one practical application. All are marked by 3 points.	30%
10.5 Laboratory	-application of specialized knowledge of the discipline in ship propulsion system design	Continues assessment by analysis of the laboratories results during the semester. The applications during the semester are marked by 3 points.	30%
		Final report on a subject regarding analysis of naval propulsion systems, solutions for improving propulsion performance of the ship. The report is marked by 4 points.	40%
10.6 Minimum performance standard			
- The right of sustaining the final examination is strictly conditioned by the delivery in due time of the report. - The final exam / colloquium passed on each evaluation state with grade 5.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos" University of Galați
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture

2. Subject details

2.1 Subject title	**Unconventional Materials**						
2.2 Lecture organizer							
2.3 Laboratory organizer							
2.4 Year of study	**I**	2.5 Semester	I	2.6 Type of assessment	**E**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	4	where: 3.2 lecture	2	3.3 laboratory	2
3.4 Total hours in the curriculum	56	where: 3.5 lecture	28	3.6 laboratory	28
Time distribution					hours
Study after manuals, syllabuses, bibliography and notes					10
Further documentation in libraries, on specialized electronic platforms and fieldwork					5
Preparing laboratory, assignments, essays, portfolios and essays					10
Tutorials					5
Examinations					3
Other activities					0

3.7 Total hours of individual study	33
3.9 Total hours per semester	89
3. 10 Number of credits	6

4. Prior learning / Prerequisites (where relevant)

4.1 curriculum-related	- Basic knowledge in Materials Sciences, process of obtaining, methods of processing, structures and usage.
4.2 competence-related	- Theory of Elasticity. Ship structures. Small ships.

5. Conditions (where relevant)

5.1. of the lecture	- Audio-visual equipments for presentations
5.2. of the laboratory	- Equipment and materials for manufacturing a sample composite laminate - Equipment for measuring strain/stress and deformations

6. Specific competences acquired

Professional competences	**C5 In-depth knowledge and development of materials and technologies used in the field of shipbuilding – 3 credits** **C6 In-depth knowledge and development of materials and technologies used in offshore engineering – 3 credits**
Transversal competences	**Not applicable**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C5.1 In-depth knowledge, analysis and synthesis of naval technologies. C5.2 Use of information sources and specialized knowledge for the analysis, evaluation and selection of technological solutions imposed in new situations. C6.1 In-depth knowledge, analysis and synthesis of the types of systems used in offshore engineering and specific technologies. C6.2 Analysis and evaluation of new offshore unit and offshore projects in order to identify optimal technological solutions.
7.2 Specific aims	C5.3 Integrated use of the information, conceptual and methodological apparatus in the development of innovative technologies. C5.4 Applying algorithms to assess the performance of new technologies to improve decision making. C5.5 Innovative use of specific technologies for the purpose of project development. C6.3 Integrated use of the information, conceptual and methodological apparatus in the development of innovative technologies. C6.4 Applying algorithms to evaluate the performances of innovative technologies in order to improve decision making. C6.5 Innovative use of specific technologies for designing projects.

8. Contents

8. 1 Lecture	Teaching method	Observations
- Composite materials, definition, classification, history, future directions, advantages, flaws	- Academic courses - Heuristic conversations - Audio-visual presentations (video projectors and interactive wall board)	4 hours
-Construction methods of composites materials, specific structural approach		4 hours
- Applications of composites in the marine industry, types of metal/composites interface, properties		4 hours
- Theory of elasticity principles, Stress/Strains Theory		2 hours
- Calculation methods regarding the use of composite materials		2 hours
- Finite Element Method for composite materials. Theory and specific approach.		12 hours

References

1. Veronique Lenoble, Cristelle Laclautre, et. all., Journal of Hazardous Materials, B123 (2005).
2. Vlase, S. – Composite materials. Methods of calculation, Transilvania University Press, Brasov, 2007
3. C.I.Mocanu, Strength of materials, 2-nd Edition revised and completed, "Dunărea de Jos" University Foundation Publishing House, Galati 2005
4. Gay, D., Matériaux composites, Editions Hermes, Paris, 1991
5. Gheorghiu, H., Hadăr, A., Constantin, N., Analysis of structures in isotropic and anisotropic materials, Printech Publishing House, Bucharest, 1998
6. Hadăr, A., Structures of layered composites, Academa and AGIR Publishing Houses, Bucharest, 2002
7. U.S. Department of Defense: Composite Materials Handbook Volume 2. Polymer Matrix Composites Materials Properties, MIL-HDBK-17-2F Volume 2 of 5, 17 JUNE 2002
8. Strong, A.B., Fundamentals of composites manufacturing: materials, methods and applications, second edition, 2007
9. Jones, R. M., Mechanics of Composite Materials, second edition, 1999;
10. Beznea, E.F. , Chirică, I., Structuri Compozite, Galati University Press, 2010, ISBN 978-606-8008-86-8
11. Bîrsan, I-G., Cîrciumaru, A., Bria, V., Roman, I., Ungureanu, V., Mechanical Characterization of Fiber Fabrics, ASME 10th Biannual Conference on Engineering Systems Design and Analysis, 2010, p. 671-674
12. ***, Composite Material Study: Maturity of Technology Materials and Fabrication, F.I.T. Structural Composites Laboratory technical report prepared for UNISYS Corporation and U.S. Navy, 1998
13. Canadian Standards Association International (CSA), Design and construction of building components with fibre reinforced polymers, CSA-S8-06, Toronto, 2002
14. Benmokrane, B., Use of fibre reinforced polymer reinforcement integrated with fibre optic sensors for concrete bridge deck slab construction, Canadian Journal of Civil Engineering, 27(5), p. 928–940, 2000
15. Temeles, A. B., Cousins, T. E., and Lesko, J. J., Composite plate and tube bridge deck design: Evaluation in the Troutville, Virginia weigh station test bed. Proceedings, 3rd Int. Conference on Advanced Composite Materials in Bridges and Structures, ACMBS-3., Canadian Society for Civil Engineering, Montreal, p. 801–808, 2000

8. 2 Laboratory	Teaching method	Observations
Components, properties, handling, precautions	-Individual presentations and focus group activities -Explanations -Case studies and case simulations -Methods to improve analytic thinking -Exercises	2 hours
Hands-on lamination of a composite plate and reinforcing structure		8 hours
Composite materials characteristics used in the shipbuilding industry. Rules data and experimental procedures.		2 hours
Register rules for small craft made in composites		2 hours
Scantling of a boat using register rules		8 hours
Development of the boat part FEM model of the composite materials structure		2 hours
Local strength analysis by FEM model of the composite materials boat part structure		4 hours

References
1. Vlase, S. – Composite materials. Methods of calculation, Transilvania University Press, Brasov, 2007
2. M. Radeș, Finite Element Method Analysis, Didactic and Pedagogic Publishing House, Bucharest, 2006
3. Computing software instructions package FEMAP
4. Allen R.G., JonesR.R., A simplified method for determining structural design limit pressures on high performance marine vehicles. In Proceedings of the AIAA/SNAME Advanced Marine Vehicle Conference, 1978;
5. Volpi, S., Sadat-Hosseini, H., Diez, M., Kim, H. D., Stern, F., Thodal, R. S., Greeenestedt, J. L., Validation of High Fidelity CFD/FE FSI for Full-Scale High-Speed Planing Hull With Composite Bottom Panels Slamming, 6th international Conference on Computational Methods for Coupled Problems in Science and Engineering, 2015
6. Pendleton, R. L., Tutle, M. E., Manual of Experimental Methods for Mechanical Testing of Composites, SEM, 1989
7. Bakis, C. E., Bank, L. C., Brown, V. L., Cosenza, E., Davalos, J. F., Machida, A., Rizkalla, S. H., Triantafillou, T. C.; Fiber-Reinforced Polymer Composites for Construction—State-of-the-Art Review, Journal of Composites for Construction, Volume 6, Issue 2, 2002, ISSN (print): 1090-0268.

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

The training offered by this discipline is to familiarize students with the use of unconventional materials (composite materials) in the construction of boats. Students will also assimilate the design and analysis knowledge of shipbuilding structures made of composite materials.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	- Understanding and developing thorough knowledge regarding the course content - Developing the basis for ship structures design and analysis made of composite materials	Final exam / semester – written examination (course and applications evaluation)	60%
		Course presence, involvement in discussions	10%
10.5 Labotory	Application of acquired knowledge in ship design and shipbuilding	Reports regarding laboratory projects and how to improve performance of analysed performances	30%
10.6 Minimum performance standard			
- The right of sustaining the final examination is strictly conditioned by the delivery in due time of the laboratory reports. - The final exam / colloquium passed on each evaluation state with grade 5.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos" University of Galați
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Date despre disciplină

2.1 Subject title	**Advanced Shipbuilding Technology 1**						
2.2 Lecture organizer							
2.3 Laboratory organizer							
2.4 Year of study	**I**	2.5 Semester	I	2.6 Type of assessment	**E**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	3	where: 3.2 lecture	2	3.3 laboratory	1
3.4 Total hours in the curriculum	42	where: 3.5 lecture	28	3.6 laboratory	14
Time distribution					hours
Study after manuals, syllabuses, bibliography and notes					6
Further documentation in libraries, on specialized electronic platforms and fieldwork					3
Preparing seminars / labs, assignments, essays, portfolios and essays					5
Tutorials					5
Examinations					3
Other activities					0

3.7 Total hours of individual study	22
3.9 Total hours per semester	66
3. 10 Number of credits	4

4. 4. Prerequisites (where relevant)

4.1 curriculum related	Shipbuilding technology
4.2 competence related	Using mathematical and physic knowledge and terms of naval architecture . Ability of professional attitude în order to define and solve engineering problems

5. Conditions (where relevant)

5.1. of the lecture	Class room , projector, PC,
5.2. of the laboratory	Naval shipyard

6. Specific competences acquired

Professional competences	**C5 In-depth knowledge and development of materials and technologies used in the field of shipbuilding – 4 credits**

Transversal competences	Not applicable

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C5.1 In-depth knowledge, analysis and synthesis of naval technologies. C5.2 Use of information sources and specialized knowledge for the analysis, evaluation and selection of technological solutions imposed in new situations.
7.2 Specific aims	C5.3 Integrated use of the information, conceptual and methodological apparatus in the development of innovative technologies. C5.4 Applying algorithms to assess the performance of new technologies to improve decision making. C5.5 Innovative use of specific technologies for the purpose of project development.

8. Contents

8. 1 Lecture	Teaching method	Observations Number of hours
1.Introduction to general notions of ship technology: rules, calendar, documents, etc.	Lecture, heuristic conversation, explanation, questioning, debate, development of critical thinking	2 hours
2.Materials and weldin gin ship construction		4 hours
3.Ship hull construction		4 hours
4.Non destructive testing in ship construction		2 hours
5.Ship outfitting: piping systems technology		2 hours
6.Ship outfitting: Alternative fuels technologies in ship construction		2 hours
7.Ship outfitting: Deck systems construction technology		2 hours
8.Ship outfitting: Locksmith, mechanical and electrical systems		2 hours
9.Ship painting		2 hours
10.Ship accomodation		2 hours
11.Ship launching		2 hours
12.Ship testing: harbor trials (HAT)/ sea trials (SAT)		2 hours
References 1. IACS Recommandation no. 47 –Shipbuilding and Repair Quality Standard 2. IMO Rules: MARPOL, SOLAS, LOAD LINE, AFS, PSPC, BWMC, COLREGS, IGF Code, 3. Ship and Marine Technology ISO (2015-2017) 4. Clasification Society Rules: DNV, LR , BV,.. 5. Ceanga, V., Lungu, A. , Paraschivescu,C.,’’Deck Machinery’’, Academica Publishing House, 2000 6. Ceanga, V., Mocanu C.I., Ungureanu C., „Ship board systems”, EDP, Bucharest, 2017 7. www.ship-technology.com		
8. 2 Laboratory	Teaching method	Observations Number of hours
1.Safety on board and workshop	Case studies, experimental works, explanations, development of technological thinking	1 hour
2.Technological flow în cutting ,mounting and assembling shop		1 hour
3.Automatic panel line		1 hour
4.Technological flow în pipe shop Galvanising workshop		1 hour
5.NDT Laboratory		1 hour
6.Quality control service		1 hour
7.Ship design workshop		2 hour
8.Ship în Progress building visit		2 hours
9.Dry Dock		1 hour
10.Attending ship launching		1 hour

11. Laboratory reports presentation, conclusions		2 hours

References
1. IACS Recommandation no. 47 –Shipbuilding and Repair Quality Standard
2. IMO Rules: MARPOL, SOLAS, LOAD LINE, AFS, PSPC, BWMC, COLREGS, IGF Code,
3. Ship and Marine Technology ISO (2015-2017)
4. Clasification Society Rules: DNV, LR , BV,..
5. Ceanga, V., Lungu, A. , Paraschivescu,C.,’’Deck Machinery’’, Academica Publishing House, 2000
6. Ceanga, V., Mocanu C.I., Ungureanu C., „Ship board systems”, EDP, Bucharest, 2017
7. www.ship-technology.com

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

- The content of the course is in accordance with the degree and standard of shipyards and ships installations.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	Examination (writing)	Estimation of the flow work of ship hull. Systems testing technology on board Capacity of analysing of testing management systems on board . . Physical interpretation of the measurement result (mechanical, thermal, hydrodynamic),	70%
10.5 Laboratory	Report	Flow work identification în the workshop . Equipment used în technological processes Specific standards. Measurements and data analyse. Conclusions	30%
10.6 Minimum performance standard			
- The student must complete the laboratory. - The final exam / colloquium passed on each evaluation state with grade 5.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos” University of Galați
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Research & Design Internship 1**						
2.2 Lecture organizer							
2.3 Internship organizer							
2.4 Year of study	**I**	2.5 Semester	I	2.6 Type of assessment	**V**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	14	where: 3.2 lecture	-	3.3 internship	14
3.4 Total hours in the curriculum	196	where: 3.5 lecture	-	3.6 internship	196
Time distribution					hours
Study after manuals, syllabuses, bibliography and notes					14
Further documentation in libraries, on specialized electronic platforms and fieldwork					14
Preparing assignments, portfolios					14
Tutorials					10
Examinations					4
Other activities:					-

3.7 Total hours of individual study	56
3.9 Total hours per semester	252
3. 10 Number of credits	10

4. Prerequisites (where relevant)

4.1 curriculum related	• Disciplines from the bachelor's degree in Naval Architecture / Mechanical Engineering. • Full assisted disciplines from the Naval Architecture Master
4.2 competence related	• Define, analyze, and use appropriate research and design systems.

5. Conditions (where relevant)

5.1. of the lecture	• -
5.2. of the internship	• Experimental and numerical laboratories within the Research Center "Naval Architecture", experimental equipment, computers, software, Internet access, bibliographic sources. • Research and design laboratories at partner internship companies.

6. Specific competences acquired

Professional competences	**C3 Propulsion system design – 3 credits** **C5 In-depth knowledge and development of materials and technologies used in the field of shipbuilding – 2 credits** **C6 In-depth knowledge and development of materials and technologies used in offshore engineering – 2 credits**
Transversal competences	**CT1 Fulfilment in due time of the design and/or the research activities in naval architecture – 1 credit** **CT2 Efficient conduct of co-ordination of the design and/or the research activities in naval architecture – 1 credit** **CT3 Assessment of the need for professional training, in the context of the evolution of the field – 1 credit**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C3.1. Description of the propulsion systems and of the technical vocabulary specific to the domain of naval architecture. C3.2. Efficient use of the acquired knowledge for explaining and interpreting the propulsion system working regimes. C5.1. In-depth knowledge, analysis and synthesis of naval technologies. C5.2. Use of information sources and specialized knowledge for the analysis, evaluation and selection of technological solutions imposed in new situations. C6.1. In-depth knowledge, analysis and synthesis of the types of systems used in offshore engineering and specific technologies. C6.2. Analysis and evaluation of new offshore unit and offshore projects in order to identify optimal technological solutions. CT1 Fulfilment in due time of the design and/or the research activities in naval architecture CT2 Efficient conduct of co-ordination of the design and/or the research activities in naval architecture CT3 Assessment of the need for professional training, in the context of the evolution of the field
7.2 Specific aims	C3.3. Identifying adequate methods, techniques, and procedures for the design of the propulsion systems under the incomplete documentation condition. C3.4. Data analysis to formulate value judgments and substantiate constructive decisions specific to propulsion systems design. C3.5. Conduct studies that use innovatory a wide range of quantitative methods specific to propulsion systems design. C5.3. Integrated use of the information, conceptual and methodological apparatus in the development of innovative technologies. C5.4. Applying algorithms to assess the performance of new technologies to improve decision making. C5.5. Innovative use of specific technologies for the purpose of project development. C6.3. Integrated use of the information, conceptual and methodological apparatus in the development of innovative technologies. C6.4. Applying algorithms to evaluate the performances of innovative technologies in order to improve decision making. C6.5. Innovative use of specific technologies for designing projects.

8. Contents

8.1 Lecture	Teaching method	Observations Number of hours
---	---	---
8.2 Internship	Teaching method	Observations Number of hours
1. Choosing the research theme	Research and design	196 hours
2. Bibliographic documentation (PhD theses, specialized books, magazines and scientific articles, etc.)		
3. Presenting the state of the art of knowledge in the field of theoretical modelling of the topic of the research topic		
4. Presenting the state of the art of knowledge in the technological field of the research topic		
5. Presenting the state of the art of knowledge in the field of experimental modelling of the research topic theme		
6. Establishing the directions of scientific research (theoretical, numerical, technological and / or experimental) on the research topic		
7. Research-design internship report		

Bibliography

1. Amoraritei, M., ”Complements of Marine Propellers Hydrodynamics in Non-uniform Flow”, Galati Univ. Press, 2008
2. Andersson, B., Andersson, R., Hakansson, L., Mortensen, M., Sudiyo, R., van Wachem, B., ”Computational Fluid Dynamics for Engineers”, Cambridge University Press, 2012
3. Betram, V., “Practical Ship Hydrodynamics”, (Ed.II) Butterworth Heinemann, Oxford, 2012
4. Babicz, J., “Wärtsilä Encyclopedia of Ship Technology“, Wärtsilä Corporation, Second Edition, Helsinki, 2015
5. Breslin, J.,P., ”Hydrodynamics of Ship Propeller”, Cambridge University Press, 2003
6. BV, „Rules for Classification and Construction”, Bureau Veritas, 2023
7. Carlton, J., S., ”Marine Propellers and Propulsion”, Elsevier, 2006
8. Domnisoru, L., “Structural Analysis and Hydroelasticity of Ships”, The „Dunărea de Jos” University Foundation Publishing House, Galati, 2006
9. Domnisoru, L., Lungu, A., Dragomir, D., Ioan, A., „Complements of Structural Analysis and Ship Hydrodynamics”, Galati University Press, 2008
10. DNV-GL., “Rules for Classification and Construction”, Det Norske Veritas & Germanischer Lloyd, 2023
11. Dragomir, D., Lungu, A., Domnisoru, L., „Naval Architecture Design Complements”, „Didactic and Pedagogic” Publising House, Bucharest, 2007
12. Eyres, D.J., „Ship Construction”, Elsevier Butterworth-Heinemann, New York, 2007
13. Ferziger, J.H., Peric, M., ”Computational Methods for Fluid Dynamics”, Springer-Verlag, Third Edition, 2002
14. Ghose, J., P., Gokarn, R., P., ”Basic Ship Propulsion”, New Delhi, 2004
15. Hadar, A., „Multilayer Composite Materials”, Academy and AGIR Publishing House, Bucharest, 2002
16. Hadar,A., Marin,C., Petre,C., Voicu,A., " Numerical Methods in Engineering ", Politehnica Press, Bucharest, 2005
17. Hirsch, C., ” Numerical Computation of Internal and External Flows: The Fundamentals of Computational Fluid Dynamics”, Butterworth-Heinemann, 2007
18. ISO 6954:2000, "Mechanical vibration — Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships", https://www.iso.org/obp/ui/#iso:std:iso:6954:ed-2:v1:en
19. ISO 20283-5:2016, "Mechanical vibration — Measurement of vibration on ships — Part 5: Guidelines for measurement, evaluation and reporting of vibration with regard to habitability on passenger and merchant ships", https://www.iso.org/ obp/ui/#iso:std:iso:20283:-5:ed-1:v1:en
20. Lewandowski, E.M., „The Dynamics of Marine Craft”, World Scientific, New Jersey, 2004
21. LR, “Ship Vibration and Noise. Guidance Notes”, Lloyd's Register, London, 2023
22. Lungu, A., (Ed) “Numerical Modeling in Engineering”, Academica Press, Galati, 2001
23. Mandal, N.R., ” Ship Construction and Welding”, Springer Nature Singapore Pte Ltd., 2017
24. Mansour, A., Liu, D., „Strength of Ships and Ocean Structures, The Principles of Naval Architecture Series, SNAME, New Jersey, 2008
25. Mocanu, C., "Strength of Materials", „Dunărea de Jos” University Foundation Publishing House, Galati, 2005
26. Obreja, D., “ Ship theory. Concepts and Methods of Navigation Performance Analysis”, „Didactic and Pedagogic” Publishing House, Bucharest, 2005

27. Okumoto, Y., Takeda, Y., Mano, M., Okada, T., “Design of Ship Hull Structures - A Practical Guide for Engineers”, Springer-Verlag, 2009
28. Paik, J.K., Thayamballi, A.K., „Ship Shaped Offshore Installations”, Cambridge University Press, 2007
29. Rao, S.S., “The Finite Element Method in Engineering”, Elsevier Science & Technology Books,, New York, 2004
30. Rawson, K.J., Tupper E.C., „Basic Ship Theory”, (2 vol) Butterworth Heinemann, Oxford, 2001
31. Rodolfo, A., White, J., “Dynamic Scheduling with Microsoft Project”, International Institute for Learning, 2011
32. Serban, D., Gavan, E., “Shipbuilding and Welding Technology”, Evrika Publishing House, Brăila, 2001
33. Spyridon, E.H., Chunhua, Ge, “Review & Introduction to Hydroelasticity of Ships”, Lloyd’s Register, London , 2005
34. Stoicescu, L., "Strength of Materials", Evrika Publishing House, Braila, 2 vol., 2004
35. Storch, R.L., Hammon, C.P., Bunch, H.M. & Moore, R.C., “Ship production”, Cornell Maritime Press, 2000
36. Schull, P.J., “Nondestructive Evaluation - Theory, Techniques, and Applications”, Marcel Dekker, New York, 2001
37. Versteeg, H., Malalasekera, W., ”An Introduction to Computational Fluid Dynamics: The Finite Volume Method”, Prentice Hall, 2007
38. Vlase, S. , „Composite Materials. Numerical Methods , “Transilvania” University Publishing House, Braşov, 2007
39. Vorus, W.S., „Vibration”, The Principles of Naval Architectures Series, SNAME, New Jersey, 2010
40. Zienkiewicz, O.C., Taylor, R.L.,”The Finite Element Method” (3 Vol.), Elsevier Butterworth-Heinemann, Oxford, 2000

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

The training includes the basic elements for integrating the graduate in the activities of the shipbuilding research and design companies, as well as for Bologna III PhD studies.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	---	---	---
10.5 Internship	Applying specialized knowledge in research and design activities	- Evaluating the weekly research-design internship that quantifies the rhythmic involvement and accuracy of the results. - Evaluation of the research-design internship report.	70% 30%
10.6 Minimum performance standard (Each evaluation part is marked in the standard reference system 1-10.)			
- The student should pass the current activities in the research and design internship. - The student should pass with the grade 5 the examination of the research-design internship report.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos" University of Galați
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Computational Fluid Dynamics 1**						
2.2 Lecture organizer							
2.3 Project organizer							
2.4 Year of study	**I**	2.5 Semester	II	2.6 Type of assessment	**E+P**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	3	where: 3.2 lecture	2	3.3 project	1
3.4 Total hours in the curriculum	42	where: 3.5 lecture	28	3.6 project	14

Time distribution	hours
Study after manuals, syllabuses, bibliography and notes	9
Further documentation in libraries, on specialized electronic platforms and fieldwork	4
Preparing seminars / labs, assignments, essays, portfolios and essays	9
Tutorials	0
Examinations	1
Other activities	0

3.7 Total hours of individual study	23
3.9 Total hours per semester	65
3. 10 Number of credits	2+2

4. Prior learning / Prerequisites (where relevant)

4.1 curriculum-related	– None
4.2 competence-related	– None

5. Conditions (where relevant)

5.1. of the lecture	– The right of sustaining the final examination is strictly conditioned by the delivery in due time of the project, as well as by getting at least the established minimum mark for it.
5.2. of the project	– The student attendance of all the scheduled project classes is compulsory.

6. Specific competences acquired	
Professional competences	**C2 Hydrodynamic optimization of the hull forms – 4 credits**
Transversal competences	**Not applicable**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C2.1 Detailing the methods, techniques and procedures for describing the concepts related to the hull forms optimization; C2.2 Explaining and sensing the applied hydrodynamics knowledge to the particular problem of a ship hull regardless of its geometry; • The subject strong formative character for the graduate acting either as a practicing engineer in a shipyard or as a researcher in the naval engineering domain. It contributes for the graduate at building up the expertise in the field of numerical simulation of the hydrodynamic processes that describe the unsteady flow around the ship hull.
7.2 Specific aims	C2.3 Complete use of the conceptual and methodologic apparatus to solve specific hydrodynamics problems related to the optimal design of the hull forms; C2.4 Applying criteria and evaluation methods with which the hull forms can be improved; C2.5 Argumentation by models and projects of the most appropriate methods for defining the optimal forms from a hydrodynamic point of view; • Developing skills for the fundamental-applied research skills in naval architecture; • Developing the fundamentals of the naval architecture and acquiring a good practice in using the most advanced techniques in research and design both in Romanian and English; • Developing the capacity of a performant fulfilling in due time of the research, design, planning, co-ordination and control tasks that occur in the daily activity of an engineer; • Developing the capacity of using the computer; • Developing the capacity for numerical simulation of specific hydrodynamic and structural resistance problems; • Developing the capacity of acquiring, processing and interpretation of the experimental data; • Developing the capacity of performing in complex and multicultural working teams; • Developing skills in efficient communication in English either face-to-face, or by making use of the modern techniques; • Developing the capacity for quick and efficient adaption in a variety of companies such as research entities, universities, institutes of the Academy and so on.

8. Contents

8. 1 Lecture	Teaching method	Observations
Getting started in numerical simulation	PowerPoint slides displayed on the intelligent board	(1 hour)
The theory of partial differential equations Classification of differential equations – Equations of elliptic type; – Equations of parabolic type; – Equations of hyperbolic type.	PowerPoint slides displayed on the intelligent board	(2 hours)
Grid generation of meshing of differential equations that describe the flow model – Quality criteria imposed to the mesh networks; – Algebraic methods to generate structured grids; – Geometrical methods of generating structured grids; – The generation by analytical methods; – Composite grids; – Adaptive grids; – Unstructured grids.	PowerPoint slides displayed on the intelligent board	(4 hours)
Fundamentals of the finite differences method – Discretization of I and II order derivatives, and the mixed derivatives – Schemes of higher order discretization; – Countercurrent schemes; – Stability, convergence, accuracy, consistency.	PowerPoint slides displayed on the intelligent board	(6 hours)
Applications of numerical methods for solving linear and nonlinear differential equations – Typical hydrodynamic equations; – Direct methods for solving. Thomas Algorithm; – Indirect methods (iterative). Jacobi method, Gauss-Seidel method, successive relaxation method; – Solving non-stationary problems. Lax equivalence theorem; – Explicit methods: Euler's method; – Implicit-explicit and implicit methods: ADI method, Douglas-Gunn method, Beam-Warming method.	PowerPoint slides displayed on the intelligent board	(7 hours)
Numerical modeling of bi and three-dimensional potential fluid flow – Boundary element method. Overview; – Induced velocities by a flat quadrangular source; – Approximation by multipolar developing of the induced velocities; – Boundary conditions. Rankine source method.	PowerPoint slides displayed on the intelligent board	(8 hours)
References 1. Roache, P.J., “Computational Fluid Dynamics”, Hermosa Publishers, 1976 2. Anderson, D.A., Tannehill, J.C., Pletcher, R.H., “Computational Fluid Mechanics and Heat Transfer” Mc. Graw-Hill, 1983 3. Fletcher, C.A.J., “Computational Techniques for Fluid Dynamics”, Vols. I & II, Springer-Verlag, 1988 4. Hoffman, K.A., Chiang, S.T., “Computational Fluid Dynamics for Engineers”, Vols. I & II, Engineering Education system, 1993 5. Lungu, A., “ Numerical modeling in hydrodynamics. Meshing”, Technical Publishing House, Bucharest, 2000 6. Lungu, A., (Ed) “Numerical Modeling in Engineering”, Academica Press, Galati, 2001 7. Ferziger, J.H., Peric, M., ”Computational Methods for Fluid Dynamics”, Springer-Verlag, Third Edition, 2002.		

8. 2 Project	Teaching method	Observations
Shipflow program overview. Lines plan allocation for the ship hull for which the numerical solution of the flow problem will be computed.	Based on the use of the minimal reference list as well as on the user manuals of the software products used in the classes (Shipflow, Tribon, Tecplot)	1:**(1 hour)**
Fairing the lines plan in Tribon. The introduction of the minimum number of sections required for correct body geometry definition.		2-3-4:**(3 hours)**
Generating britfair files associated with the ship offset lines. Conversion of britfair coordinates in off-set file needed for the Shipflow computer program.		5:**(1 hour)**
Setup of the off-set and the command files.		6:**(1 hour)**
Generating the panel network for the hull and the free surface. Local mesh correction. Plotting in Tecplot the discretization.		7:**(1 hour)**
XPAN computations of free surface and hydrodynamic flow parameters in "standard case" mode. Linear computation for a given speed. Tecplot visualization of velocity and pressure fields and wave geometry.		8:**(1 hour)**
Case study on the influence of the resolution of the panel distribution in the free surface and around the ship hull. Linear calculation for a given speed. Graphical comparisons. Mesh convergence tests.		9-10:**(2 hours)**
Computation of frictional resistance in XBOUND. Tecplot visualization of velocity, pressure and friction coefficient on the ship hull.		11:**(1 hour)**
Nonlinear XPAN computation of the free-surface flow for a range of five speeds around the speed of service. Tecplot visualization of velocity and pressure fields and wave geometry. Comparison between the linear and nonlinear solutions.		12-13:**(2 hours)**
The completion of the project, delivery and presentation.		14:**(1 hour)**

Minimal reference list

1. Lungu, A., (Ed) “Numerical Modeling in Engineering”, Academica Press, Galati, 2001
2. Ferziger, J.H., Peric, M., ”Computational Methods for Fluid Dynamics”, Springer-Verlag, Third Edition, 2002
3. Flowtech International AB, “Shipflow 6.4 – User’s Manual”, Chalmers University of Technology Press, 2018

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

The subject goals are as follows:

- The adequate acquaintance and use of the partial differential equations that define the free-surface potential flow around a ship hull;
- Acquaintance and thorough understanding of the PDE’s that describes the boundary layer development around the ship hull;
- Skills regarding:
  - Worth motivation of the numerical solutions through the post-processing data techniques;
  - Technical solutions choices for reducing the ship resistance;
  - Hydrodynamic hull forms optimization;
- Proving a positive attitude towards the scientific achievement;
- Implication in the institutional development as well as in the scientific innovation;
- Engaging in partnerships with other similar scientific entities;

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	Written partial assessment	Written examination at which the student has to answer to nine theoretical questions and nine practical ones. Each one is marked by 0.5 points. A supplementary point is added only for those who participate to get the final mark	50%
	Written final assessment	Written examination at which the student has to answer to nine theoretical questions and nine practical ones. Each one is marked by 0.5 points. A supplementary point is added only for those who participate to get the final mark.	50%
10.5 Project	Final project defending	Oral examination based on the defending of the solutions chosen in the project	100%
10.6 Minimum performance standard			
– The student should have the project submitted at the due date and defended successfully; – Intermediate reports successfully taken; – The intermediate exam should be marked at least with 5; – The final exam should be graded at least with 5; – The final examination show is conditioned not only by the project delivery but also by a minimal grade of 5 for its defense. The final mark will be composed by 30%, of the score of the partial defend and 40% of the score of the final defend.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos" University of Galati
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Structural Analysis and Hydroelasticity**						
2.2 Lecture organizer							
2.3 Project organizer							
2.4 Year of study	**I**	2.5 Semester	II	2.6 Type of assessment	**E+P**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	4	where: 3.2 lecture	2	3.3 project	2
3.4 Total hours in the curriculum	56	where: 3.5 lecture	28	3.6 project	28

Time distribution	hours
Study after manuals, syllabuses, bibliography and notes	10
Further documentation in libraries, on specialized electronic platforms and fieldwork	4
Preparing seminars / labs, assignments, essays, portfolios and essays	0
Tutorials	5
Examinations	5
Other activities: project	10

3.7 Total hours of individual study	34
3.9 Total hours per semester	90
3. 10 Number of credits	3+3

4. Prerequisites (where relevant)

4.1 curriculum related	• Strength of Materials, Mechanics, Vibrations, Fluid Mechanics, Physics, Mathematical Analysis, Linear Algebra, Special Mathematics, Numerical Methods, Programming, Technical Design and Infographic
4.2 competence related	• Adapt of general design concepts in naval architecture. • Define, analyze and use appropriate integrated design, calculation and analysis systems.

5. Conditions (where relevant)

5.1. of the lecture	• Classroom, laptop, video projector, whiteboard
5.2. of the project	• Numeric laboratory, computers, CAD / FEM software, OpenOffice, DYN, Internet access, bibliographic sources, project guide.

6. Specific competences acquired

Professional competences	**C4 Advanced design of ship structures – 6 credits**
Transversal competences	**Not applicable**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C4.1. Defining and specifying methods, techniques and procedures for describing concepts specific to the advanced design of ship structures. C4.2. Classification and use of methods, techniques and procedures for analyzing concepts specific to advanced design of new ship structures.
7.2 Specific aims	C4.3. Apply the appropriate methods and techniques for the advanced design of ship structures under incomplete information to solve new theoretical problems. C4.4. Evaluate and interpret data specific to the advanced design of ship structures to substantiate constructive decisions. C4.5 Making models and designing projects that use innovative qualitative and quantitative methods specific to the advanced ship structures design. Developing projects using concepts specific to the advanced design of ship structures.

8. Contents

8.1 Lecture	Teaching method	Observations Number of hours
PART I The ship structures analyses with the finite element method (special chapters)	Lecture, heuristic conversation, explanation, questioning, debate, development of critical thinking	*Part I*
Ch.1 Introduction. The analysis of the global ship strengths with 3D/1D-FEM hull models. The theoretical models for the analysis of global-local ship strengths (head waves). The global ship strengths analysis based on 1D-girder classical method. The global - local ship strengths analysis based on 3D-FEM models. The numerical global-local strengths analysis for a ship with uniform hull. The numerical global-local strengths analysis for a tanker ship. Global strength analysis by 1D - beam method, in the case of oblique equivalent quasi-static wave load (drill-ship example). Global strength analysis by 3D-FEM full developed ship model, under oblique equivalent quasi-static wave load (off-shore barge example). Numerical examples: tank ship with uniform longitudinal structure, floating docks, LPG ship. User code for applying wave pressures to the ship's hull. Rules. Model ship balancing software in design equivalent waves (DYN).		C1 (2 hours)
Ch.2 The global ship hull vibrations analyses based on 3D-FEM models. The theoretical models for the analysis of global ship hull free vibrations. Hydrodynamic masses at ship hull vibrations. The ship girder classical analysis at free vibrations with 1D–FEM models. The analysis of global ship hull free vibrations with 3D–FEM finite element models. The numerical vertical, horizontal and torsion ship hull free vibrations analysis, based on 1D-FEM and 3D-FEM Models, for a ship with uniform structure. Rules. Numerical examples: bulk-carrier ship, LPG ship.		C2 (2 hours)
Ch.3 The buckling structural analysis based on the finite element method (3D-FEM ship model). The buckling analysis formulation. The pre-stressing (geometrical) rigidity matrix for: truss, bending girder and rectangular thin plate element. The general formulation. The reduction of the buckling analysis to an equivalent mathematic eigen values and vectors problem. Numerical examples: ROV vehicle, floating docks, oil tanker ship.		C3 (2 hours)

Ch.4. 3D-FEM structural analysis of a prismatic hull with multiple cargo compartments. Development of the 3D-CAD model for a cargo compartment. Development of the 3D-FEM model for a cargo compartment. Development of the 3D-FEM model along the entire length of the ship, extended in one side. Modeling of boundary conditions and load in the cargo compartments. Analysis of general-local strength in the cases: calm water, equivalent design wave on sagging or hogging wave. Buckling analysis for the three load cases. Global vertical vibration analysis in case of dry hull ship. Global vertical vibration analysis with consideration of fluid-structure interaction, by including additional hydrodynamic masses.		C4 (2 hours)
Ch.5 Non-linear static and dynamic analyses based on the finite element method. Types of nonlinearities: material constitutive, geometric and boundary conditions. Numerical methods for solving the non-linear equilibrium equations. Iterative methods. Direct substitution method. Newton-Raphson method. Modified Newton-Raphson method. Incremental methods. Euler method Inverse Broyden method. Elastic-plastic analyzes of uniaxial condition structures of stress and strains. Elements of plasticity theory for materials with uniaxial condition. Example of elastic-plastic analysis to uniaxial state problems. The tangent rigidity method, uniaxial state (1D state). Relations for small plastic deformations of 3D state structure. The general elastic-plastic model of the material. The von Mises criterion. Kinematic hardening. Tangent stiffness method (3D state). FEM nonlinear dynamic analysis. Dynamic balance equations. The average acceleration method. Analysis of structural problems with geometric nonlinearities (large displacements). Example of numerical analysis FEM nonlinear, static and dynamic. Methods for ultimate bending moment analysis of ship hulls with stresses from equivalent quasi-static head waves. The limit state in reference to the ultimate strength of the ship's hull and to the loss of structural stability. a) Nonlinear static analysis of a deck orthotropic panel. Solver variants: 1.Static, 10. Nonlinear Static, 22. Advanced Nonlinear Static, 24. Advanced Nonlinear Explicit (static). b) Nonlinear dynamic analysis of a deck orthotropic panel. Solver variants: 3. Transient Dynamic (linear), 12. Nonlinear Transient Response, 23. Advanced Nonlinear Transient, 24. Advanced Nonlinear Explicit (dynamic). c) Nonlinear strength analysis of a typical joint in a marine structure (static and dynamic). Solver variants: 1.Static, 10. Nonlinear Static, 3. Transient Dynamic, 12. Nonlinear Transient Response. d) Nonlinear coupled thermal-structural analysis for a deck orthotopic panel (thermal steady state and transient, thermal loading-unloading). Solver variants: 20. Steady-State Heat Transfer, 1. Static, 10. Nonlinear Static; 21. Transient Heat Transfer, 10. Nonlinear Static. e) Nonlinear analysis of the strength of a submersible structure (immersion-emersion). Solver variants: 1.Static, 10. Nonlinear Static. f) Nonlinear static and dynamic analysis of a constructive detail frame. Solver variants: 1. Static, 10. Nonlinear Static, 3. Transient Dynamic, 12. Nonlinear Transient Response. g) Impact analysis between a rigid body and isotropic plate. Definition of rigid-deformable contact. Solver variant: 24. Advanced Nonlinear Explicit SOL701. h) Impact analysis between a deformable structure and an orthotropic floor. Definition of deformable-deformable contact. Solver variant: 24. Advanced Nonlinear Explicit SOL701.		C5-C9 (10 hours)
PART II Ship Hydroelasticity		*Part II*
Ch.6 Special phenomena induced by the waves at the forced general ship hull vibration. The Springing phenomenon (linear and non-linear). The Whipping and Slamming phenomena. Experimental analysis of springing and whipping phenomena. Synthesize on the linear ship's hull oscillations analysis. Application: On a river-costal tug operation safety assessment in irregular waves.		C10 (2 hours)
Ch.7 The linear dynamic response at coupled oscillations and vibrations in the vertical plane (linear springing). The hypothesis of analysis. The motion differential equations in vertical plane. Orthogonal relations of the eigen vibration modes. The motion equations in vertical plane with principal modal coordinates. The calculation of the motion equations system coefficients using the finite element method (FEM). The equivalent linear wave (Airy model). The hydrodynamic forces (strip theory, using two formulations). The solution of the equations system in principal modal coordinates. The transfer functions at ship oscillations / vibrations coupled in the vertical plane. Elements of the statistical short time prediction of ship dynamic response. Application: The linear numerical analysis of displacement response amplitude operator, based on the hydroelasticity theory, for a barge test ship. The linear dynamic response at horizontal-torsional coupled ship oscillations and vibrations. The hypothesis. Open transversal section. The motion differential equations. The orthogonally relations of the eigen vibration modes. The motion equations system in principal modal coordinates. The hydrodynamic excitation at the horizontal-torsional motion. The dynamic response at oscillations /vibrations horizontal-torsional coupled. The transfer functions. The dynamic response at oscillations and vibrations horizontal-torsional, for ships with close transversal section. The motion equations. The generalized hydro-dynamic forces. The solution of the motion equations.		C11 (2 hours)

Ch.8 The simplified analysis of the whipping dynamic response and the bottom slamming. The bottom slamming phenomenon occurrence conditions. The motion equations system. The transitory-whipping ship dynamic response. Application: Oil tanker in ballast condition; The numerical analysis of transitory dynamic response, based on the non-linear hydroelasticity theory, for a barge test ship. Synthesize on the non-linear ship's hull oscillations analysis. Application: The experimental and numerical linear and non-linear analyses of oscillations response, based on a scaled ITTC type ship model.		C12 (2 hours)
Ch.9 The non-linear analysis of the ship dynamic response at coupled oscillations-vibrations in the vertical plane, non-linear hydroelasticity. Hypothesis of analysis. The Longuet-Higgins wave model. The hydrodynamic forces. The dynamic response at Longuet-Higgins wave with linear analysis. The dynamic non-linear and transitory hydroelastic response. Applications: Non-linear hydroelastic analyses for a large bulk-carrier ship, chemical tanker ships, LPG carrier ship, container carrier ship, off-shore drill ship.		C13 (2 hours)
Ch.10 The analysis of fatigue resistance and the estimation of the exploitation period of the ship hull structure. The long time period statistical analysis. The steps of the fatigue strengths analysis. Register requirements. The S-N design diagram. The check at the fatigue strengths of the ship hull structure. The admissible values method for the maxim stresses. The Palmgren-Miner method, of the damage cumulative factor. Rules. Applications: Fatigue long term structural analyses with hydroelastic loads for: LPG carrier ship, large LNG carrier ship, large oil-tanker, large bulk-carrier, off-shore barge.		C14 (2 hours)

Bibliography

PART I The ship structures analyses with the finite element method (special chapters)

1. Bathe, K.J., "Finite Elemente Methoden", Springer Verlag, Berlin, 1990
2. BV, „Rules for Classification and Construction", Bureau Veritas, 2023
3. BV, „Mars User's Guide", Bureau Veritas, 2005-2023
4. Domnişoru, L., " Finite Element Method in Shipbuilding", Technical Publishing House, Bucharest, 2001
5. Domnişoru, L., "Structural Analysis and Hydroelasticity of Ships", (eBook, English and Romanian), The „Dunărea de Jos" University Foundation Publishing House, Galati, 2006
6. Domnişoru, L., „Structural Analysis and Hydroelasticity of Ships. Project Support", ", (eBook, English and Romanian), The „Dunărea de Jos" University Foundation Publishing House, Galati, 2007
7. Domnişoru, L., "Special Chapters on Ships' Structures Analysis. Applications", ", (eBook, English), The „Dunărea de Jos" University Foundation Publishing House, Galati, 2017
8. Domnişoru, L., Lungu, A., Dumitru, D., Ioan, A., „Complements of Structural Analysis and Ship Hydrodynamics", Galati University Press, 2008
9. DNV-GL., "Rules for Classification and Construction", Det Norske Veritas & Germanischer Lloyd, 2018
10. DNV-GL, "Poseidon User's Guide", Det Norske Veritas & Germanischer Lloyd,1999-2018
11. Eyres, D.J., „Ship Construction", Elsevier Butterworth-Heinemann, New York, 2007
12. Friecke, W., „Guideline for the Fatigue Assessment by Notch Stress Analysis for Welded Structures", Technical University Hamburg Harburg, 2008
13. FEMAP, „Femap / NX Nastran User's Guide", Siemens PLM Software Inc., 2016-2023
14. Hadăr A., Marin C., Petre C., Voicu A., " Numerical Methods in Engineering ", Politehnica Press, Bucharest, 2005
15. Hughes, T.J.R., "The Finite Element Method. Linear Static and Dynamic Finite Element Analysis", Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1987
16. Hughes, O.F., "Ship Structural Design. A Rationally-based, Computer-Aided Optimization Approach", The Society of Naval Architects and Marine Engineers, New Jersey, 1988
17. Lehmann, E., "Matrizenstatik. Finite Elementen Methode", TUHH Hamburg-Harburg, 2001
18. Liu, G.R., Quek S.S., „The Finite Element Method", Elsevier Butterworth-Heinemann,Oxford,2003
19. Mansour, A., Liu, D., „Strength of Ships and Ocean Structures, The Principles of Naval Architecture Series, SNAME, New Jersey, 2008
20. Mocanu C., "Strength of Materials", „Dunărea de Jos" University Foundation Publishing House, Galati, 2005
21. Năstăsescu, V. "Finite Element Method", Military Publishing House, Bucharest, 1995
22. Paik J.K., Thayamballi A.K., „Ship Shaped Offshore Installations", Cambridge University Press, 2007
23. Rao, S.S., "The Finite Element Method in Engineering", Elsevier Science & Technology Books,, New York, 2004
24. Reddy, J.N., "An Introduction to the Finite Element Method", McGraw-Hill, New York, 2006
25. SWCM, "Cosmos/M User's Guide", SRAC / SolidWorks, 1998-2000, 2007-2008
26. Soares, C.G., Garbatov, Y. (editor) "Proceedings of the 19-th International Ship and Offshore Structures Congress ISSC", University of Lisboa, 2015

27. Stoicescu L., "Strength of Materials", Evrika Publishing House, Braila, 2 vol., 2004
28. Zienkiewicz O.C., Taylor R.L., ”The Finite Element Method. Basic Formulation and Linear Problems”, McGraw-Hill Book Company, London, 1988
29. Zienkiewicz, O.C., Taylor, R.L.,”The Finite Element Method. Solid and Fluid Mechanics. Dynamics and Non-Linearity”, McGraw-Hill Book Company, London, 1989
30. Zienkiewicz, O.C., Taylor, R.L.,”The Finite Element Method” (3 Volumes), Elsevier Butterworth-Heinemann, Oxford, 2000

PART II Ship Hydroelasticity

1. Betram, V., “Practical Ship Hydrodynamics”, (Ed.II) Butterworth Heinemann, Oxford, 2012
2. Bidoae, I., Ionaş, O., ”Complements of Naval Architecture”, Porto-Franco Publishing House, Galaţi, 1998
3. Bishop, R.E.D., Price W.G., “Hydroelasticity of Ships”, Cambridge University Press, 1979
4. Claus, G., Lehmann, E.,Östergaard, C.,”Meerestechnische Konstruktion”, Springer Verlag, Berlin,1989
5. Domnişoru, L., “ Ship Dynamics. Oscillations and vibrations of the ship's body”, Technical P.H., Bucharest, 2001
6. Domnişoru, L., “Structural Analysis and Hydroelasticity of Ships”, (eBook, English and Romanian), The „Dunărea de Jos” University Foundation Publishing House, Galati, 2006
7. Domnisoru, L., Lungu, A., Dumitru, D., Ioan, A.,„Complements of Structural Analysis and Ship Hydrodynamics”, Galati University Press, 2008
8. Faltinsen, O.M., “Sea Loads on Ships and Offshore Structures”, Cambridge Univ. Press, 1993
9. ISSC, „The 21-th International Ship and Offshore Structures Congress”, Vancouver, 11-15 September 2022
10. ITTC, “Recommended Procedures and Guidelines. Global Loads Seakeeping Procedure (7.5-02-07-02.6)”, International Towing Tank Conference, 2017
11. Kornev, N., „Ship Dynamics in Waves”, University of Rostock, 2011
12. Lewandowski E.M., „The Dynamics of Marine Craft”, World Scientific, New Jersey, 2004
13. Obreja, D., “ Ship theory. Concepts and methods of navigation performance analysis”, Didactic and Pedagogical Publishing House, Bucharest, 2005
14. Price W.G., Bishop R.E.D. Probabilistic Theory of Ship Dynamics, Chapman and Hall, London, 1974
15. Perunovic, J.V., “Springing Response due to Bidirectional Wave Excitation”, PhD Thesis, Technical University of Denmark, Department of Mechanical Engineering, 2005.
16. Rawson K.J., Tupper E.C., „Basic Ship Theory”, (2 vol) Butterworth Heinemann, Oxford, 2001
17. Spyridon, E.H., Chunhua, Ge, “Review & Introduction to Hydroelasticity of Ships”, Lloyd’s Register, London , 2005
18. Schlachter, G., “Belastung von Schiffen im Seegang unter Berucksichtigung nichtlinearer Einflusse”, Institut fur Schiffbau der Universitat Hamburg, 1990
19. Shacham I, Weller, T. “Vertical Ship Motions and Sea Loads Considering Nonlinear Effects”, Technion Istrael Institute of Technology, Haifa, 1986
20. Söding, H., “Bewegungen und Belastungen der Schiffe im Seegang”, TUHH Hamburg, 1994
21. Troesch, A.W., “Ship Springing An Experimental and Theoretical Study”, Univ. of Michigan, 1980
22. Vorus, W.S., „Vibration”, The Principles of Naval Architectures Series, SNAME, New Jersey, 2010

8.2 Project	Teaching method	Observations Number of hours
1. Local strength of ship’s hull, model 1D. Generating the structure in the midship’s part of the hull and checking the local / global strength, using rules and Poseidon/DNVGL or MARS/BV programs. Oil tankers, bulk carriers or container ships.	Case studies, numerical simulations, explanations, development of critical thinking	P1 (2 hours)
2. Development of 3D-CAD/FEM model full extended over the ship’s hull length. The central area is about 70-75% of the length of the vessel and 25-30% is the area at the extremities. The shape of the ship is simplified, vertical sides and flat bottom, with the inclusion of transverse bulkheads. The idealization of cargo loads, boundary conditions and the structural model are generated using the Femap/NX Nastran program.		P2 – P6 (10 hours)
3. Global / local strength of ship’s hull, model 3D. Equilibrium of the ship in calm water and at equivalent design wave EDW (sagging & hogging). User functions (Femap/NX) with equilibrium parameters obtained on 1D-beam model used to apply calm water and EDW wave pressures. 3D-FEM stress and strain assessment according to the criteria of DNVGL & BV naval classification society rules.		P7- P9 (6 hours)
4. Buckling checking of the ship’s hull structure, model 3D. Buckling analysis for ship structure subjected to stresses from equivalent design waves and calm water.		P10 (2 hours)

5. Analysis of the general vibration in the vertical plane of the ship's hull, using the 3D-FEM model extended over the entire length of the ship's hull, with and without additional masses. The 3D-FEM model generated in the previous steps with the Femap/NX Nastran program is used. Completion and presentation of the project.		P11-P14 (8 hours)

Bibliography

1. BV, „Rules for Classification and Construction", Bureau Veritas, 2023
2. BV, „Mars User's Guide", Bureau Veritas, 2005-2023
3. Domnişoru, L., "Structural Analysis and Hydroelasticity of Ships", (eBook, English and Romanian), The „Dunărea de Jos" University Foundation Publishing House, Galati, 2006
4. Domnişoru, L., "Special Chapters on Ships' Structures Analysis. Applications", (eBook, English), The „Dunărea de Jos" University Foundation Publishing House, Galati, 2017
5. DNV-GL., "Rules for Classification and Construction", Det Norske Veritas & Germanischer Lloyd, 2023
6. DNV-GL, "Poseidon User's Guide", Det Norske Veritas & Germanischer Lloyd,1999-2023
7. Eyres, D.J., „Ship Construction", Elsevier Butterworth-Heinemann, New York, 2007
8. FEMAP, „Femap / NX Nastran User's Guide", Siemens PLM Software Inc., 2016-2023
9. Mansour, A., Liu, D., „Strength of Ships and Ocean Structures, The Principles of Naval Architecture Series, SNAME, New Jersey, 2008
10. Rawson K.J., Tupper E.C., „Basic Ship Theory", (2 vol) Butterworth Heinemann, Oxford, 2001

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

The discipline has a strong formative character in the profile of the practitioner and researcher of the master student in the field of naval architecture. This specialized discipline consists of two parts: analysis of structures by the finite element method (special chapters) and hydroelasticity of the ship, through which the graduate accumulates the practical knowledge of the modern techniques of calculating the ship structures, as well as of the hydroelasticity of the ship (oscillations and vibrations coupled). Through its content, the discipline aims to provide master student, through the course and project activities, the following knowledge and skills:

-learning the special chapters about the analysis by the finite element method of the ship structures: static and dynamic, linear and nonlinear, buckling;

-learning the modelling techniques of the global-local ship hull strength by 3D-FEM models full extended over the ship length, using automatic equilibrium procedures;

-learning the computation techniques for the natural vibration modes of the ship hull by 3D-FEM models full extended over the ship length;

-learning the methods of ship's dynamic response analysis for coupled oscillations and vibrations, in the hypotheses of the hydroelasticity theory;

-learning the procedures for estimating the ship's lifetime by fatigue analysis.

These competences are required by employers in the labor market, both in the country and abroad, involved in the research and design activities in naval architecture.

10.Assesment

<table>
<tr><th>Activity</th><th>10.1 Assessment criteria</th><th>10.2 Assessment methods</th><th>10.3 Percentage of the final grade</th></tr>
<tr><td rowspan="2">10.4 Lecture</td><td rowspan="2">- Understanding and assimilating specialized knowledge of the subject
- Formation of the basis of reasoning required in the design and research activity for linear and nonlinear, local and global analysis, static and dynamic, buckling, fatigue of the ship structures by the finite element method, and computation of hydroelastic loads induced by irregular waves in the elastic beam of the ship, according to the rules of ship classification societies.</td><td>The final exam is composed of two parts as follows:
(30%) assessment by a study case of the student abilities for ship structures FEM nonlinear analysis (elasto-plastic);
(60%) Synthesis theoretical report and a set of associated questions. which quantifies the level of acquiring knowledge of advanced analysis techniques for FEM ship hull global strength, buckling, fatigue, as well as hydroelastic modelling (oscillations and vibrations) of the ship dynamic response induced by waves in the ship hull structure.</td><td>90%</td></tr>
<tr><td>Presence at the course, participation in debates, stimulation of critical thinking.</td><td>10%</td></tr>
<tr><td>10.5 Project</td><td>Application of specialized knowledge of the discipline in the design activity for static and dynamic structural analysis of the ship.</td><td>The evaluation of the project, which quantifies the rhythmic involvement and the correctness of the obtained numerical results, as well as the final project content.</td><td>100%</td></tr>
<tr><td colspan="4">10.6 Minimum performance standard (Each evaluation part is marked in the standard reference system 1-10.)</td></tr>
<tr><td colspan="4">- The student must complete the project.
- The final exam / colloquium passed on each evaluation state with grade 5.</td></tr>
</table>

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos” University of Galaţi
1.2 Faculty	Naval Architecture / Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Experimental Analysis of Noise and Vibrations**						
2.2 Lecture organizer							
2.3 Seminar / Recitation organizer							
2.4 Year of study	**I**	2.5 Semester	II	2.6 Type of assessment	**E**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	4	where: 3.2 lecture	2	3.3 seminar/recitation/lab	2
3.4 Total hours in the curriculum	56	where: 3.5 lecture	28	3.6 seminar/recitation/lab	28

Time distribution	hours
Study after manuals, syllabuses, bibliography and notes	10
Further documentation in libraries, on specialized electronic platforms and fieldwork	6
Preparing seminars / labs, assignments, essays, portfolios and essays	10
Tutorials	3
Examinations	4
Other activities	0

3.7 Total hours of individual study	33
3.9 Total hours per semester	89
3. 10 Number of credits	6

4. Prior learning / Prerequisites (where relevant)

4.1 curriculum-related	• Resistance of materials, Mechanic and vibrations, Fluid Mechanic, Physic, Mathematical Analysis, Electronic, Superior Mathematics, Design and info-graphics
4.2 competence-related	• Adaptation at the general concepts in naval architecture; • Defining, analysis and general using of the integrated systems regarding design, calculus and analysis

5. Conditions (where relevant)

5.1. of the lecture	• Room, laptop, video projector
5.2. of the laboratory	• Noise and vibrations measuring instruments, calibrators, computers, data acquision board, software for downloading and processing signals ((BZ5503, Noise Explorer, Vibroexpert, CAT 78 SW, DA 20 Viewer), Internet access, references, Laboratory Guide, Project Guide (in electronic form)

6. Specific competences acquired

Professional competences	**C3 Propulsion system design – 3 credits** **C4 Advanced design of ship structures – 3 credits**
Transversal competences	**Not applicable**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C3.1 Description of the propulsion systems and of the technical vocabulary specific to the domain of naval architecture. C3.2 Efficient use of the acquired knowledge for explaining and interpreting the propulsion system working regimes. C4.1 Defining and specifying methods, techniques and procedures for describing concepts specific to the advanced design of ship structures. C4.2 Classification and use of methods, techniques and procedures for analyzing concepts specific to advanced design of new ship structures.
7.2 Specific aims	C3.3 Identifying adequate methods, techniques, and procedures for the design of the propulsion systems under the incomplete documentation condition. C3.4 Data analysis to formulate value judgments and substantiate constructive decisions specific to propulsion systems design. C3.5 Conduct studies that use innovatory a wide range of quantitative methods specific to propulsion systems design. C4.3 Apply the appropriate methods and techniques for the advanced design of ship structures under incomplete information to solve new theoretical problems. C4.4 Evaluate and interpret data specific to the advanced design of ship structures to substantiate constructive decisions. C4.5 Making models and designing projects that use innovative qualitative and quantitative methods specific to the advanced ship structures design. Developing projects using concepts specific to the advanced design of ship structures.

8. Contents

8. 1 Lecture	Teaching method	Observations hours
I. NOISE	Lecture, heuristic conversation, explanation, debate, the development of a critical thinking	C1 (2 hours)
Ch. 1 Ch.**1.1 Noise and the human** Ch.**1.2 Acoustic concepts** Ch.**1.3 Sound** Ch. **1.4 Noise and tones** Ch. **1.5 Frequency, Hertz** Ch. **1.6 Infrasound and Ultrasound** Ch. **1.7 Decibel dB** Ch. **1.8 Sound Level Measurement, dB** Ch. **1.9 Equivalent Sound Pressure Level, LAeq,T**		
Ch. 2 Ch. **2.1 Attenuation of Structure-borne sound** Ch. **2.2 Attenuation by using absorbents** Ch. **2.3 Sound Insulated Rooms** Ch. **2.4 Planning the building** Ch. **2.5 Noise Reduction Measures in rooms** Ch. **2.7 Purchase and Installation of Machinery** Ch. **2.8 A program for noise control**		C2 (2 hours)
Ch. 3 Cap. **3.1 EXPERIMENTAL NOISE ANALYSIS: RESOLUTION MSC.337(91) (adopted on 30 November 2012) CODE ON NOISE LEVELS ONBOARD SHIPS** Cap. **3.2 MEASURING EQUIPMENT** Cap. 3.**3 MEASUREMENT** Cap. **3.4 MAXIMUM ACCEPTABLE SOUND PRESSURE LEVELS** Cap. 3.**5 NOISE EXPOSURE LIMITS** Cap. 3.**6 ACOUSTIC INSULATION BETWEEN ACCOMMODATION SPACES** Cap. 3.**7 HEARING PROTECTION AND WARNING INFORMATION**		C3 (2 hours)

Ch. **4.** **Appendix 1: FORMAT FOR NOISE SURVEY REPORT** 4.1. Ship particulars 4.2 Machinery particulars 4.3 Measuring instrumentation 4.4 Conditions during measurement 4.5 Measuring data 4.6 Main noise abatement measures (list measures taken) 4.7 Remarks (list any exceptions to the Code) ATTACHMENT (FREQUENCY ANALYSIS) **Appendix 2: GUIDANCE ON THE INCLUSION OF NOISE ISSUES IN SAFETY MANAGEMENT SYSTEMS** Cap. **Appendix** 3: SUGGESTED METHODS OF CONTROLLING NOISE EXPOSURE 4.8. General 4.9 Isolation of sources of noise 4.10 Exhaust and intake silencing 4.11 Machinery enclosure 4.12 Reduction of noise in the aft body 4.13 Enclosure of the operator 4.14 Controls in accommodation spaces 4.15 Selection of machinery 4.16 Inspection and maintenance 4.17 Vibration isolation **Appendix 4: SIMPLIFIED PROCEDURE FOR DETERMINING NOISE EXPOSURE** 4.18 Case study: 41000 dwt Chemical Oil Tanker		C4 (2 hours)
II. UNDERWATER NOISE		C5 (2 hours)
Cap. **5. UNDERWATER NOISE** **SECTION 1: GENERAL REQUIREMENTS** Cap. **A. Introduction** Cap. **B. Definitions** Cap. **C. Documentation requirements** **SECTION 2: UNDERWATER NOISE** Cap. **A. General** Cap. **B. Underwater noise requirements** Cap. **SECTION 3: MEASUREMENTS AND TESTING** **APPENDIX A: MEASUREMENT PROCEDURE** Cap. **A. Scope** Cap. **B. Test Procedures** Cap. **C. Recording of data**		
		C6 (2 hours)
Cap.6 **APPENDIX A: MEASUREMENT PROCEDURE** Cap. **A. Scope** Cap. **B. Test Procedures** Cap. **C. Recording of data**		
III. NOISE PREDICTION		C7 (2 hours)
Ch. 7 **Cap. 7.1 Generalities** **Cap. 7.2 Structure damping coefficients** **Cap. 7.3 Acoustic coefficients related by internal damping** **Cap. 7.4 Damping coefficients in coupling** **Cap. 7.5 Stages in SEA model** **Cap. 7.6 Experimental model for tests in laboratory (case study)** **Cap. 7.7 Numerical model in statistic energy analysis** **Cap. 7.8 Theoretical model in FEM** **Cap. 7.9 Preliminary results and conclusions**		
Ch. 8 Cap. **8.11 Experimental determination of sound reduction index for sound insulation in case of mineral wool** Cap. **8.12 Experimental determination of damping coefficient** Cap. **8.13 Matrix equation** Cap. **8.14 Results analysis**		C8 (2 hours)
IV. NOISE BY SAFETY REASON		C9 (2 hours)
Ch. 9 Cap. **9.1 General emergency alarm system** Cap. **9.2 Public address system** Cap. **9.3 Adding and Subtracting Sound Levels** Cap. **9.4 Adding sound pressure levels (strictly mathematic without taking in consideration propagation aspects)**		
V. VIBRATIONS		C10 (2 hours)
Ch. 10 **Cap. 10.1. EXPERIMENTAL VIBRATIONS ANALYSIS** **Cap. 10.1. GENERAL** **Cap. 10.2. VIBRATION CHECK PROCEDURE** **Cap. 10.3 Design concept investigation (Stage1)**		

Cap. 10.4 Main propulsion engine **Cap. 10.5. SHAFTING VIBRATION** **Cap. 10.5.1 General** **Cap. 10.5.2 Longitudinal vibration** **Cap. 10.5.3 Torsional vibration** **Cap. 10.5.4 Whirling vibration** **Cap. 10.5.5 Local structure vibration**		C11 (2 hours)
Cap. 11 APPENDIX A: COMPUTER PROGRAMS **Cap. 11.1. Propeller Excitation** **Cap. 11.2. Axial Vibration in Shafting** **Cap. 11.3. Torsional Vibration in Shafting** **Cap. 11.4. Whirling Vibration in Shafting** **Cap. 11.5. Hull Girder Vibration** **Cap. 11.6. Local Structure Vibration** **Ch. 12 APPENDIX B: NUMERICAL EXAMPLES APPLICATION OF THE GUIDELINES** Cap. **12.1. Example 1** Cap. **12.2 Ship data given** Cap. **12.3 Stage I: Investigation**		C12 (2 hours)
Cap. 13. Example 2 **Cap. 13.1 Ship data given** **Cap.13.2 Stage I: Investigation** **Cap. 13.3 Stage I: Results** **Cap. 13.4 Stage II: Investigation** **Cap. 13.5 Stage II: Results** **Cap. 13.6. Example 3** **Cap. 13.7 Ship data given** **Cap. 13.8 Stage I: Investigation** **Cap. 13.9 Stage I: Results** **Cap. 13.10 Stage II: Investigation and results** **Cap. 13.11 Stage III: Investigation and results**		C13 (2 hours)
Cap. 14. VIBRATIONS CRITERIA **Cap. APPENDIX 1: FORMAT FOR VIBRATIONS SURVEY REPORT** **14.1. Ship particulars** **14.2 Machinery particulars** **14.3 Measuring instrumentation** **14.4 Conditions during measurement** **14.5 Measuring data** **14.6 Main noise abatement measures (list measures taken)** **14.7 Remarks (list any exceptions to the Code)** **14.8 Case study: 41000 dwt Chemical Oil Tanker**		C14 (2 hours)

Bibliography

1. Prevention on harmful vibrations in ships – DNV Norway;
2. ISO 4867 (Code for the measurement and reporting of ship-board vibration data);
3. ISO 4868 (Code for the measurement and reporting of local vibration data of ship structures and equipment);
4. ISO 10816 (Mechanical vibration – Evaluation of machine vibration by measurements on non-rotating parts);
5. BUILDING AND OPERATION OF VIBRATION-FREE PROPULSION PLANTS AND SHIPS (NR 207 SMS E) APPENDIX D.X. GUIDELINES FOR THE OVERALL EVALUATION OF VIBRATIONS IN MERCHANT SHIPS (BUREAU VERITAS);
6. BUILDING AND OPERATION OF VIBRATION-FREE PROPULSION PLANTS AND SHIPS (NR 207 SMS E) CH. C RESPONSES OF PROPULSION APPARATUS AND AUXILIARY ENGINES (BUREAU VERITAS);
7. ISO 6954 – 1984 (Mechanical vibration and shock - Guidelines for the overall evaluation in merchant ships);
8. ISO 2631/1: Evaluation of human exposure to whole-body vibration. Part 1: General requirements;
9. ISO 2631/2: Evaluation of human exposure to whole-body vibration. Part 2: Continuous and shock-induced vibration in buildings (1 to 80Hz);
10. ISO 2631/3: Evaluation of exposure to whole-body vibration. Part 3: Evaluation of human exposure to whole-body z-axis vertical vibration in the frequency range 0.1 to 0.63 Hz.

8.2.2 Laboratory	Teaching method	Observations
Study of noise analyzer type 2250 (manufactured by Bruel & Kjaer-Denmark); microphone, wind mask, *front end* and *rear end*;	Study cases, explinations, development of the critical thinking	L1 (2 ore)
Study of noise analyzer type 2250 (manufactured by Bruel & Kjaer-Denmark); menu and setup; calibration with noise calibrator NV 74 manufactured by Rion (Japan): standard signal 93.8 dB / 1 kHz;		L2 (2 ore)
Study of noise analyzer type 2250 (manufactured by Bruel & Kjaer-Denmark); downloading recorded data, online with PC;		L3 (2 ore)
Study of noise analyzer type 2250 (manufactured by Bruel & Kjaer-Denmark); recording data by every student; recordings *in situ* of street traffic;		L4 (2 ore)
Study of noise analyzer type 2250 (manufactured by Bruel & Kjaer-Denmark); recording data by every student; recordings *in situ* of street traffic;		L5 (2 ore)

Study of portable digital recorder, with 4 channels type DA 20 manufactured by RION-Japan; recordings *in situ* of the street traffic;		L6 (2 ore)
Calibration using the calibrator type PCB 394C06 manufactured by PCB-USA (1 g rms / 160 Hz); calibration using the calibrator type 4291 (manufactured by Bruel & Kjaer-Denmark:1 g peak / 80 Hz)		L7 (2 ore)
Study of portable vibration analyzer type VIBROPORT 41 (manufactured by Schenk - Bruel & Kjaer); accelerometers, photoprobe for rpm recording, *front end* and *rear end*;		L8 (2 ore)
Study of portable vibration analyzer type VIBROPORT 41: showing menu and setup;		L9 (2 ore)
Study of portable vibration analyzer type VIBROPORT 41: showing data downloading, online with PC;		L10 (2 ore)
Study of portable vibration analyzer type VIBROPORT 41: performing recordings by every student; recordings *in situ* of street traffic;		L11 (2 ore)
Study of portable vibration analyzer type VIBROPORT 41: performing recordings by every student; recordings *in situ* of street traffic; Data processing using CAT78-WR software; voyage on Danube river when every student will perform data recording onboard a passenger vessel to evaluate COLEGIU ship, by noise and vibrations point of view;		L12 (2 ore)
Study of portable digital recorder DA 20, with 4 channel; recordings *in situ* of noise from street traffic; processing data using CAT78-WR software.		L13 (2 ore)
Study of data acquisition board DAQ 6024 manufactured by National Instruments - USA, type PCMCI, with 16 channels; recordings *in situ* of street traffic;		L14 (2 ore)

Bibliography

1. Bruel&Kjaer, "*Measurements Noise*", 1992
2. Marek IWANIEC, Jerzy WICIAK, "*ACOUSTICAL MODELLING OF THE DOUBLE ALUMINIUM PLATE SYSTEM BY THE USE OF THE SEA METHOD*", *Molecular and Quantum Acoustics vol. 24, (2003)*;
3. Central Institute for Labour Protection. *Guidelines for Designing Anti-Noise Protection at Work Stations in Industrial Shops*, (1993);
4. A Schmitz, A. Meier, G. Raabe, "*Inter-Laboratory Test of Sound Insulation Measurements on Heavy Walls, Part I – Preliminary Test*". Building Acoustics 6(3), p.159-169, (1999).
5. Leo L. Beranek, ed., *Noise and vibration control*, McGraw-Hill 1 971Rawson K.J., Tupper E.C., „Basic Ship Theory", (2 vol) Butterworth Heinemann, Oxford, 2001
6. R.H.Warring, *Handbook of noise and vibration control*. Trade and Technical Press Ltd., 1970;
7. Bruel&Kjaer, "*Instruction Manual type 2250*";
8. Schenk-Bruel&Kjaer, "*Instruction Manual type Vibroport 41*";
9. RION, „*Instruction Manual type DA 20*".

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme.

The object has a strong educationaly character in order to model a good research and practician master student in naval architecture domain. The object has two experimental chapter: the noise and the vibration.

The purpose is that the student to accumulate the practical knowledgment regarding the modern acquisition technics, data processing, storing and reporting of vibroacoustic data.

By the content, the object desires to assure to master student, via course activities, project and laboratories, the following knowledge and abillities:

- acquiring the main parameters which interfere in the process related the control of noise and vibrations onboard ships; case study;
- acquiring the acoustic prognosis method using statistical energy analysis (SEA), case study;
- acquiring measurement procedures to measure noise and vibrations;
- acquiring processing techniques of data resulted from measurements of vibrations and noise; case study;
- acquiring analysis methods of general and local vibrations onboard ships;
- acquiring the knowledge to execute assessments by noise and vibrations point of view onboard ships; cases study;

These competencies are required on the work market by employers, from Romania or foreign, implicated in research and design activities in naval architecture domain also the employers which build and repair ships.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	- Understanding and assimilation of particulars knowledge of the object - building the basis of reasonings nedeed in design and research activities for the analysis of noise and vibrations (local and general), according to criteria of naval classification societies	The final examination is composed of two trial as followings: (1/2) verification by a case study of the analysis abilities of the of noise and vibrations onboard river passenger vessel; (1/2) written examination which quantify the level of techniques knowledge in acquisition, processing, storing and reporting of data resulted from measurings of noise and vibrations	20%
		Presence at lectures, debates participation, stimulation of critical reflection	20%
10.5 Seminar/lab	Presence at all laboratories	Work in teams of 2 - 3 master students per instruments group	30%
	Elaboration of a project	Vibroacoustic assessment of a ship chosen by the master student	30%
10.6 Minimum performance standard (Every trial is standard recorded in the reference system 1 - 10)			
• The master student must perform all laboratories and must finalize the project; • Final examination / verification must graduate with 5 note.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos” University of Galați
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Advanced Shipbuilding Technology 2**						
2.2 Lecture organizer							
2.3 Laboratory organizer							
2.4 Year of study	**I**	2.5 Semester	II	2.6 Type of assessment	**E**	2.7 Type of subject	**Compulsory**

3. Total average time (hours of teaching activities per semester)

3.1 Total hours per week	3	where: 3.2 lecture	2	3.3 laboratory	1
3.4 Total hours in the curriculum	42	where: 3.5 lecture	28	3.6 laboratory	14
Time distribution					hours
Study after manuals, syllabuses, bibliography and notes					7
Further documentation in libraries, on specialized electronic platforms and fieldwork					3
Preparing seminars / labs, assignments, essays, portfolios and essays					4
Tutorials					5
Examinations					3
Other activities					0

3.7 Total hours of individual study	22
3.9 Total hours per semester	64
3. 10 Number of credits	4

4. Prerequisites (where relevant)

4.1 curriculum related	• Strength of Materials, Shipbuilding Technology
4.2 competence related	• Corresponding to Grids 1 and 2 - Naval Architecture for the disciplines in 4.1.

5. Conditions (where relevant)

5.1. of the lecture	• Classroom, laptop, videoprojector, whiteboard
5.2. of the laboratory	• Laboratory guide, Quality Standards, Ship Design Worksheets. Performing the laboratory works at Damen Shipyard SA Galati

6. Specific competences acquired

Professional competences	**C5 In-depth knowledge and development of materials and technologies used in the field of shipbuilding – 4 credits**
Transversal competences	**Not applicable**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	C5.1 In-depth knowledge, analysis and synthesis of naval technologies. C5.2 Use of information sources and specialized knowledge for the analysis, evaluation and selection of technological solutions imposed in new situations.
7.2 Specific aims	C5.3 Integrated use of the information, conceptual and methodological apparatus in the development of innovative technologies. C5.4 Applying algorithms to assess the performance of new technologies to improve decision making. C5.5 Innovative use of specific technologies for the purpose of project development.

8. Contents

8.1 Lecture	Teaching method	Observations Number of hours
1.Welding processes of metals. General considerations. Classification. Technological schemes of different welding processes.	Lecture, heuristic conversation, explanation, questioning, debate, development of critical thinking	C1 (2 hours)
2.DC electric arc. Physical phenomena in the electric arc. Priming and forming the electric arc. The static characteristic of the DC electric arc.		C2 (2 hours)
3.AC electric arc. AC electric arc with a resistance in the circuit. AC electric arc with an inductance in the circuit. AC electric arc with a resistance and an inductance.		C3 (2 hours)
4.Stability of the electric arc and welding process. The static stability of the electric arc and the external characteristics of the welding power sources. Dynamic characteristics of welding power sources.		C4 (2 hours)
5.Power sources for welding. Classification. Transformers for electric arc welding. Adjusting the welding current. Transformers for multiple stations. Welding generators with increased frequency. DC welding generators (converters).		C5-C6 (4 hours)
6.Selecting welding power sources. DC power sources. AC power sources.		C7 (2 hours)
7.Automatic and semiautomatic welding. General considerations. Particularities of the electric arc for automatic welding. Self-regulation and automatic regulation of submerged arc. Equipment for semiautomatic/automatic submerged arc welding.		C8-C9 (4 hours)
8.Equipment for gas welding. Assumptions of analysis. Equipment for atomic hydrogen welding (AHW). Equipment for wolfram inert gas welding (W.I.G.). Equipment for metal inert gas welding (M.I.G.). Equipment for metal active gas welding (M.A.G.).		C10 (2 hours)
9.Welded joints. Joint types. Butt joint. Geometric elements. Preparation of plate edges for butt welds. T-joints. Geometric elements. Edge preparation. Welding symbols.		C11 (2 hours)
10.Welding consumable used in shipbuilding. Criteria for selecting welding consumable. Electrodes for manual welding. Welding wire/flux for submerged arc welding.		C12 (2 hours)
11.Calculation of general deformations of welding hull units. Deformations and longitudinal stresses caused by the longitudinal joints. Longitudinal deformations caused by the transverse joints. Deformations and longitudinal displacements caused by the cumulative effect of the longitudinal and transverse joints. Models for the calculation of general deformations caused by the welding of hull units, taking into account the current assembly and welding technologies.		C13- C14 (2 hours)

Bibliography
1. Şerban, D., Găvan, E., 2001, "Shipbuilding and welding technology", Evrika Publishing House, Brăila.
2. Miloși, V., 1982, "The basics of welding processes", Technical Publishing House, Bucharest.
3. Şerban, D., 2000, "Theoretical and experimental researches on the thermo-elastic and plastic stresses and deformations of the shell and the naval structure elements", PhD Thesis, „Dunărea de Jos" University of Galați.
4. Tudor, Gh., 2000, "Contributions regarding the mechanization and automation of technological systems for the welding of flat sections", PhD Thesis, „Dunărea de Jos" University of Galați.
5. Zgură, G., ş.a., 1983, "Welding technology by melting", Didactical and Pedagogical Publishing House, Bucharest.

8.2 Laboratory	Teaching method	Observations Number of hours
1.Power sources for welding. Mode of operation, technical performance.	Case studies, experimental works, explanations, development of technological thinking	L1 (2 hours)
2.Semiautomatic and automatic welding. Equipments. Mode of operation, technical performance.		L2 (2 hours)
3.Equipments for metal inert and active gas. Mode of operation, technical performance.		L3 (2 hours)
4.Welding technology of flat panels assembly. Flat panels line.		L4 (2 hours)
5.Welding technology of curved panels. Universal mounting plate.		L5 (2 hours)
6.Welding technology of the hull units in normal and inverted position.		L6 (2 hours)

7.The technology of assembling and welding the ship's hull. The influence of removing mounting additions.		L7 (2 hours)
Bibliography 1. Şerban, D., Găvan, E., 2001, “Shipbuilding and welding technology”, Evrika Publishing House, Brăila. 2. Șerban, D., 2000, “Theoretical and experimental researches on the thermo-elastic and plastic stresses and deformations of the shell and the naval structure elements “, PhD Thesis, „Dunărea de Jos” University of Galați. 3. IACS, Rec 047, 2010, “Shipbuilding and Repair Quality Standard”. 4. Quality standard Damen Shipyards.		

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

The discipline has a strong formative character in the profile of the practitioner and researcher of the master student in the field of advanced shipbuilding technology. Through its content, the discipline aims to provide the master student through the course and laboratory activities the following knowledge and skills: - knowledge and understanding of the manufacturing processes of the structural elements that make up the ship's hull; - explanation and interpretation of the theoretical models of calculation of technological processes of welding; - interpreting the various possible technological variants for assembling technologies to optimize production; - acquiring the knowledge necessary to develop the assembly and welding technologies, the measuring and control instruments used; - assimilation of the technological design knowledge required for the correct selection of the naval design solutions; - involvement in the promotion of modern technical/technological solutions, their conception and practical application; - strengthening the skills related to the correct assessment of the technical solutions adopted and their optimal implementation in practice in terms of technology; - understanding the importance of the link to individual preparation related to the process of developing a technology project. These skills are required by labour market employers, both in the country and abroad, involved in research and design activities in the field of advanced shipbuilding technologies.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	- Understanding and assimilating specialized knowledge of the subject - Knowledge of modern methods of naval technological design, development of skills necessary to solve such problems, skills training for the coordination and control of the shipbuilding activities.	Oral examination for the final exam, based on a synthesize theory report, which quantifies the level of acquiring theoretical knowledge regarding the subject of the course.	40%
		Presence at the course, participation in debates, stimulation of critical thinking.	20%
10.5 Laboratory	Application of specialized knowledge of the discipline in the welding activity of the ship hull units.	By carrying out laboratory work on the shipyard, the involvement in the debate of technical solutions is monitored through the tracking of technological processes directly into production.	40%
10.6 Minimum performance standard (Each evaluation part is marked in the standard reference system 1-10.)			
- The student must complete the laboratory. - The final exam / colloquium passed on each evaluation state with grade 5.			

SUBJECT OUTLINE

1. Academic programme details

1.1 Higher Education Institution	„Dunărea de Jos" University of Galați
1.2 Faculty	Naval Architecture
1.3 Department	Naval Architecture
1.4 Study area / Field	Naval Architecture
1.5 Programme degree	Master of Engineering
1.6 Study programme / Qualification	Naval Architecture / Naval Architecture

2. Subject details

2.1 Subject title	**Advanced digital skills**						
2.2 Lecture organizer							
2.3 Seminar organizer							
2.4 Year of study	**I**	2.5 Semester	II	2.6 Type of assessment	**V**	2.7 Type of subject	**Compulsory**

3. Timpul total estimat (ore pe semestru al activităţilor didactice)

3.1 Total hours per week	2	where: 3.2 lecture	1	3.3 laboratory	1
3.4 Total hours in the curriculum	28	where: 3.5 lecture	14	3.6 laboratory	14
Time distribution					hours
Study after manuals, syllabuses, bibliography and notes					4
Further documentation in libraries, on specialized electronic platforms and fieldwork					1
Preparing seminars, assignments, portfolios					3
Tutorials					1
Examinations					1
Other activities:					-

3.7 Total hours of individual study	10
3.9 Total hours per semester	38
3. 10 Number of credits	2

4. Prerequisites (where relevant)

4.1 curriculum related	• Not the case
4.2 competence related	• Not the case

5. Conditions (where relevant)

5.1. of the lecture	• Classroom, laptop, videoprojector, whiteboard
5.2. of the seminar	• Classroom, laptop, videoprojector, whiteboard

6. Specific competences acquired	
Professional competences	**Not the case**
Transversal competences	**CT1 Fulfilment in due time of the design and/or the research activities in naval architecture – 1 credit** **CT2 Efficient conduct of co-ordination of the design and/or the research activities in naval architecture – 1 credit**

7. Learning outcomes (as resulting from the grid of specific competences acquired)

7.1 General aim of the subject	- Developing the ability to comprehend, use, and compare the digital skills. - Participating in multidisciplinary teams and demonstrating communication skills by supporting professional projects.
7.2 Specific aims	- Developing the capabilities of knowledge, appreciation and valorisation of the european digital skills; - Developing the skills to identify and solve problems in digital advanced computing;

8. Contents

8.1 Lecture	Teaching method	Observations Number of hours
1. TOWARDS A DIGITAL EUROPE - THE EUROPEAN DIGITAL COMPETENCE FRAMEWORK. Understanding digital skills. Digital skills levels: basic, intermediate, and advanced. Continuum of digital skills Digital skills frameworks. Emerging and specialized skills.	Lecture, explanation, problem, debate, critical thinking development	C1 (2 hours)
2. INFORMATION AND DATA LITERACY. Browsing and Searching for Information. Analyse, critically evaluate and compare information and data collected. Store collected information and data.		C2 (2 hours)
3. COMMUNICATION AND COLLABORATION. Interacting through digital technologies, Sharing information and content. Online Civic Engagement.		C3 (2 hours)
4. COMMUNICATION AND COLLABORATION. Collaborating through digital technologies. Netiquette. Managing Digital Identity.		C4 (2 hours)
5. DIGITAL CONTENT CREATION. Developing digital content. Integrating and re-elaborating digital content. Copyright and licenses. Programming.		C5 (2 hours)
6. SAFETY. Protecting devices. Protecting personal data and privacy. Protecting health and wellbeing. Protecting the environment.		C6 (2 hours)
7. PROBLEM SOLVING. Problem with electronic mail account. Problem with Wi-Fi. Problems opening files and sharing content in the cloud's disk. How to get rid of malware.		C7 (2 hours)

Bibliography

1. Ordinul Ministerul Educaţiei nr. 4.150 din 29 iunie 2022 pentru aprobarea cadrului de competenţe digitale al profesionistului din educaţie, Publicat în Monitorul Oficial nr. 700 din 13 iulie 2022
2. Redecker, C. - European Framework for the Digital Competence of Educators: DigCompEdu. Punie, Y. (ed). EUR 28775 EN. Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73494-6, doi:10.2760/159770, JRC107466
3. DigComp: The European Digital Competence Framework, Luxembourg: Publications Office of the European Union, 2018, ISBN 978-92-79-91756-1, doi:10.2767/744360
4. Coward, C. et. all, "Digital Skills Toolkit", International Telecommunication Union, Geneva, 2018, ISBN 978-92-

61-26521-2.
5. Grosseck, G.; Crăciun, D., “Ghid practic de resurse educaționale și digitale pentru instruire online.” Editura Universității de Vest Timișoara, 2020, ISBN 978-973-125-790-7
6. Brolpito, A., „Digital skills and competence, and digital and online learning”, © European Training Foundation, Turin, 2018
7. Ivus, M., Quan, T., Snider, N., „21st Century Digital Skills: Competencies, Innovations and Curriculum in Canada”, Information and Communications Technology Council (ICTC), March 2021.

8.2 Laboratory	Teaching method	Observations Number of hours
1. Information and data literacy - Online shopping	Debate. Exercise	L1 (2 hours)
2. Communication and collaboration - Managing communication and social media	Debate. Exercise	L2 (2 hours)
3. Digital content creation - Getting a new job	Debate. Exercise	L3 (2 hours)
4. Safety – Conecting with high schools	Debate. Exercise	L4 (2 hours)
5. Problem solving - Do you like cookies?	Debate. Exercise	L5 (2 hours)
6. Digital skills - Test your digital skills!	Online test assesment	L6 (2 hours) L7 (2 hours)

Bibliography

1. DigComp: The European Digital Competence Framework, Luxembourg: Publications Office of the European Union, 2018, ISBN 978-92-79-91756-1, doi:10.2767/744360
2. "DQ Skills course on Digital Competences for Active Citizenship!” (http://www.dqskills.webspecialista.com/), 2018
3. Europass – Test your digital skills, Digital Skills Assesment Tool available online at https://europa.eu/europass/digitalskills/screen/home , European Commission, Directorate-General for Communication, © European Union, 1995-2023

9. Subject relevance to the epistemic community representatives, to professional associations and main employers in fields significant for the programme

The content of the discipline responds to the thematic areas in the field addressed on a national and international level at this level of studies, constituting premises for the development of professional and transversal digital skills of students.

10. Assessment

Activity	10.1 Assessment criteria	10.2 Assessment methods	10.3 Percentage of the final grade
10.4 Lecture	- identifying and understanding the notions and concepts taught at the course.	-active participation in the course through relevant interventions	10%
10.5 Laboratory	- solving the work tasks - argumentative exercise; debate	-adequacy and quality of resources used	10%
		- the originality of the exercises solving and / or of the argumentative approach - the level of critical thinking assimilation and the capacity to integrate it into the debate of ideas	30%
		- the result obtained on the online digital skills assesment	50%

10.6 Minimum performance standard
• Understanding the entire system of references with which this discipline operates, considered basic in modeling the behavior of all actors in the academic and economic environment; • Development of specific language to the digital domain; • The final grade obtained must be at least 5 (five) for the discipline to be considered passed.