DETAILED PROPOSAL OF THE STUDY PROGRAMME

GRADUATE UNIVERSITY STUDY NAVAL ARCHITECTURE

SPLIT, February 2022

1.1. List of mandatory and elective courses

List of courses								
Year of study: 1								
Semester: 1								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	CE	
Mandatory	FESN01	Marine engines	30	0	30	0	0	6
	FESL10	Finite element method	30	0	15	0	15	5
	FETJ01	Project management	30	0	30	0	0	4
Elective	FESN20	Sailboats	30	0	0	0	15	5
	L = lecture, S = seminar, AE = auditory exercise, LE = laboratory, CE = constructive exercise							

List of courses								
Year of study: 2								
Semester: 3								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	CE	
	FESN23	Vibrations and vibration control	30	0	0	30	0	5
	L = lecture, S = seminar, AE = auditory exercise, LE = laboratory, CE = constructive exercise							

1.2. Course description

NAME OF THE COURSE	Marine engines						
Code	FESN01	Year of study	1				
Course teacher	Gojmir Radica	Credits (ECTS)	6				
Associate teachers	Dario Bezmalinović Ivan Tolj Tino Sumić	Type of instruction (number of hours)	P	S	AE	LE	CE
			30	0	30	0	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Students will gain knowledge about the basic principles of marine propulsion and auxiliary machineries and devices, about the methods of their applications, basic knowledge about parameters calculations.		
Course enrolment requirements and entry competences required for the course			
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: – Analyze basic principles of marine propulsion and auxiliary machineries and devices, – Critically discuss about selection of main propulsion engine and auxiliary machinery for requested application, energy demand and according to rules and regulation, – Choose elements of propulsion system, fuel, oil, cooling systems and exhaust and ventilation system.		
Course content broken down in detail by weekly class schedule (syllabus)	Content	L hours	AE hours
	Marine propulsion systems development. Steam boilers.	2	2
	Marine steam turbines.	2	2
	Marine gas turbines.	2	2
	Marine propulsion engines.	2	2
	Engine combustion.	2	2
	Scavenging and exhaust.	2	2

	Turbochargers.	2	2
	Main parameters of marine engines	2	2
	Application of marine engine. Test bed and sea trial.	2	2
	Fuel, oil, cooling systems.	2	2
	Marine auxiliary engines, pumps, compressors.	2	2
	Propeller systems.	2	2
	Diesel-electric propulsion. Combined propulsion systems. IMO regulation.	2	2

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ individual assignments ☐ multimedia ☐ laboratory ☐ work with mentor ☐ individual project (other)
Student responsibilities	Class attendance.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	2	Research		Practical training	
	Experimental work		Report		Individual work	2,7
	Essay		Seminar essay		Lab exercises	
	Tests	0,2	Oral exam		(Other)	
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	Continuous assessment during class.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Radica G. Predavanja iz predmeta Brodski propulzijski sustavi		e-learning
	Grljušić M. Pogonski pomorski sustavi. Interna skripta, FESB, 2001.	5	
	Šneller S, Parat Ž. Pogon broda II. Sveučilište u Zagrebu, FSB, 1999.	5	

Optional literature (at the time of submission of study programme proposal)	– Harrington, R.L., "Marine Engineering", SNAME, N.J. USA, 1992. – Haarlas, M., "Steam and Gas Turbines for Marine Propulsion", Naval Institute Press, Annapolis, Maryland, 1987. – Parat, Ž., "Brodski motori s unutarnjim izgaranjem", Sveučilište u Zagrebu, FSB,2005. – Ozretić, V., "Brodski pomoćni strojevi i uređaji", Split Ship Management, Split, 2004.		
Quality assurance methods that ensure the acquisition of exit competences	The annual analysis of examination efficacy. Student survey in order to evaluate teachers. Self-evaluation of teachers. Feedback from students who have already graduated from the relevance of the course content. Occasionally, observation and evaluation of teaching by the Head of Naval Architecture Department.		
Other (as the proposer wishes to add)	Available in English language.		

NAME OF THE COURSE	**Finite Element Method**						
Code	FESL10	Year of study	1				
Course teacher	Željan Lozina	Credits (ECTS)	5				
Associate teachers	Damir Sedlar Ivan Tomac	Type of instruction (number of hours)	P	S	AE	LE	CE
			30	0	15	0	15
Status of the course	Mandatory	Percentage of application of e-learning	0				
COURSE DESCRIPTION							
Course objectives	The course objective is to provide the necessary theoretical and practical background for FEM implementation in engineering practice and additionally support for advanced studies within the field of finite elements and structural mechanics.						
Course enrolment requirements and entry competences required for the course	None						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: – Understand the basic theory behind the finite element method a. Strong and weak formulation b. Virtual work and variation formulation c. Basics of the approximate solution of PDE – Use the finite element method for the solution of practical engineering problems – Use a commercial FE-package						

<table>
<tr><td></td><td colspan="6">– Analyze more advanced topics within the field of finite elements and structural mechanics.</td></tr>
<tr><td rowspan="14">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Content</td><td>L hours</td><td>AE hours</td></tr>
<tr><td colspan="4">Basic concepts, 1D. Truss element. Direct approach.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Virtual work and problem formulation (1D) Discretization.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Function approximation concepts, approximation basis (1D). Strong formulation.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Weak formulation. Correlation with virtual work (1D). FEM discretization.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Interpolation functions in FEM: mapping, isoparametric elements. (1D)</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Potential problems in 2D and 3D: Laplace and Poisson equation.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Gauss theorem. Green equation. Weak formulation for potential problems and FEM in 2D.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Shape function and isoparametric elements in 2D.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Theory of elasticity in 2D – overview. Virtual work formulation.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Discretization of weak formulation and corresponding virtual work formulation, CST.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Elasticity in 3D, Termo-elasticity. Axisymmetric problems.</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Selected topics in FEM: Dynamics</td><td>2</td><td>2</td></tr>
<tr><td colspan="4">Selected topics in FEM: Elastic stability</td><td>2</td><td>2</td></tr>
<tr><td colspan="4"></td><td></td><td></td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures
☐ seminars and workshops
☒ exercises
☐ on line in entirety
☐ partial e-learning
☐ field work</td><td colspan="3">☒ individual assignments
☐ multimedia
☐ laboratory
☐ work with mentor
☐ individual project (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="6">Class attendance.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2</td><td>Research</td><td>1</td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Lab exercises</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Continuous assessment during class. Exam: individual and group. Exam: the theoretical and practical (application software). Examination: oral (presentation of tasks assigned for independent work and discussion about research related to the topic of the tasks).</td></tr>
<tr><td rowspan="2">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td colspan="2">Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">Ž. Lozina: Introduction in finite element methods, FESB. (in Croatian)</td><td colspan="2"></td><td>e-learning</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">– K.-J. Bathe: Finite Element Procedures, Prentice Hall Inc., 1996.
– Thomas J.R. Hughes: The Finite Element Method, Dover Publications Inc., 2000.</td></tr>
</table>

Quality assurance methods that ensure the acquisition of exit competences	The annual analysis of examination efficacy. Student survey in order to evaluate teachers. Self-evaluation of teachers. Feedback from students who have already graduated from the relevance of the course content. Occasionally, observation and evaluation of teaching by the Head of Naval Architecture Department.
Other (as the proposer wishes to add)	Available in English language.

NAME OF THE COURSE		**Project management**					
Code	FETJ01	Year of study	1				
Course teacher	Ivica Veža	Credits (ECTS)	4				
Associate teachers	Marko Mladineo	Type of instruction (number of hours)	P	S	AE	LE	CE
			30	0	30	0	0
Status of the course	Elective	Percentage of application of e-learning					

COURSE DESCRIPTION

Course objectives	Students learn to: – plan and manage projects – be able to calculate the profitability of the project and return on investment (ROI)		
Course enrolment requirements and entry competences required for the course			
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: – Analyze the requirements of the customer (VOC) – Formulate main objectives of project and rank them – Develop the main activities of the project and the structure of the distribution of work - (Work Breakdown Structure) – Plan time (to determine the critical path) – Plan capacities (specify bottlenecks and balancing activities) – Plan costs and risks – Apply the acquired knowledge and skills from the contents of the completion of cases to solve a specific task – Combine and apply their knowledge and skills in teamwork		
Course content broken down in detail by weekly class schedule (syllabus)	Content	L hours	AE hours
	Introduction and basic terms	2	2
	Term and definition of projects and project management	2	2
	Project - vision, strategy, goals (examples - automotive and shipbuilding industries).	2	2

	The strategy and project management. Multi project management.	2	2
	Basics of organization. Project organizational structure.	2	2
	Phase of the project (initiation of projects, project selection, project planning, project management, project completion)	2	2
	Methods for project planning.	2	2
	Quality management (planning, improvement and quality control)	2	2
	Cost management. Continuous improvement - Kaizen.	2	2
	Risk management.	2	2
	Psycho-social component of project management. Project manager.	2	2
	Teamwork.	2	2
	Communication and motivation on the team. Methods for enhancing creativity.	2	2

Format of instruction	☒ lectures ☒ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☒ individual assignments ☐ multimedia ☐ laboratory ☒ work with mentor ☐ individual project (other)
Student responsibilities	Class attendance.	

Screening student work *(name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)*						
	Class attendance	1	Research	0	Practical training	
	Experimental work		Report		Individual work	1,5
	Essay		Seminar essay		Lab exercises	
	Tests		Oral exam	0	(Other)	
	Written exam		Project	2,5	(Other)	

Grading and evaluating student work in class and at the final exam	During the semester, students are introduced into the stages of the project management, and parallel on laboratory exercises how to develop their own project. The students will work in teams, with a minimum number of two and maximum number of three students, in which they how to create and manage their own projects. During the course each team determines the content of the project and the main objectives. After that, they develop the main activities of the project and structure of labor division (WBS); plan the time for each of the activities of and determine the critical path; plan capacity and determine bottlenecks and balancing capacity. And finally determine the costs, calculate the profitability of the project (ROI) and analyze risks. At the colloquium and exam students present their works, which are evaluated (grade M). On the other hand, students have colloquium on Technique of network planning (AV) - 1 written colloquium at the end of the semester. • AV - colloquies Technique of network planning • M - points to the project. The final score (in percentage) is formed according to the formula: Rating (%) = 0.30 AV + 0.70 M

Required literature (available in the	**Title**	**Number of copies in the library**	**Availability via other media**

library and via other media)	Veža, I., Bilić, B., Gjeldum, N., Mladineo, M., "Upravljanje projektima", FESB, Split, 2011.		e-learning portal
	Majstorović, V. Projektni menadžment, Sveučilište u Mostaru, Mostar, 2010.	5	
	Omazić, M.A. Projektni menadžment, Sinergija, Zagreb, 2005.	5	
Optional literature (at the time of submission of study programme proposal)	– A Guide to the Project Management Body of Knowledge. PMBOK Guide, Project Management Institute, Newtown Square, 2004. – Wysocki RK, McGary R. Effective Project Management: Traditional, Adaptive, And Extreme. John Wiley & Sons, 2003.		
Quality assurance methods that ensure the acquisition of exit competences	The annual analysis of examination efficiency. Student's survey in order to evaluate teachers. Self-evaluation of teachers. Feedback from students who have already graduated about the relevance of the course content.		
Other (as the proposer wishes to add)	Available in English language.		

NAME OF THE COURSE	**Sailboats**						
Code	FESN20	Year of study	1				
Course teacher	Branko Blagojević	Credits (ECTS)	5				
Associate teachers	Klement Jadrešić	Type of instruction (number of hours)	P	S	AE	LE	CE
			30	0	0	0	15
Status of the course	Elective	Percentage of application of e-learning	0				
COURSE DESCRIPTION							
Course objectives	Understanding fundamental principles of sailing. Understanding the process of sailboat design and performance assessment.						
Course enrolment requirements and entry competences required for the course							

<table>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="3">Students will be able to:

– Explain the fundamental concept of sailing.
– Describe various sources of hull resistance and estimate resistance and speed using specific software.
– Optimize sailing performance within defined limits.
– Calculate the strength of a mast.</td></tr>
<tr><td rowspan="18">Course content broken down in detail by weekly class schedule (syllabus)</td><td>Content</td><td>lecture hours</td><td>hours</td></tr>
<tr><td>The fundamental concept of sailing. Overview of parameters influencing sailboat performanc</td><td>2</td><td></td></tr>
<tr><td>Sailboat hull form.</td><td>2</td><td></td></tr>
<tr><td>Forces and moments. Loads.</td><td>2</td><td></td></tr>
<tr><td>Stability.</td><td>2</td><td></td></tr>
<tr><td>Design methods.</td><td>2</td><td></td></tr>
<tr><td>Hull materials. Structural design.</td><td>2</td><td></td></tr>
<tr><td>Hydrdodynamics: visocus resistance, friction resistance, wave resisitance.</td><td>2</td><td></td></tr>
<tr><td>Roughness, added resistance on waves, other resistances.</td><td>2</td><td></td></tr>
<tr><td>Seakeeping.</td><td>2</td><td></td></tr>
<tr><td>Sails. Aerodynamic forces.</td><td>2</td><td></td></tr>
<tr><td>Masts.</td><td>2</td><td></td></tr>
<tr><td>Interaction of masts and sails in weak and strong winds.</td><td>2</td><td></td></tr>
<tr><td>Assessment of performance. VPP programs.</td><td>2</td><td></td></tr>
<tr><td>Field work on a sailboat.</td><td>2</td><td></td></tr>
<tr><td>Visit to shipyards.</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Work on the project with assistance (in the lab/classroom).</td><td></td><td>15</td></tr>
<tr><td>Format of instruction</td><td colspan="2">☒ lectures
☒ seminars and workshops
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☐ laboratory
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☒ individual project (other)</td></tr>
</table>

<table>
<tr><td>Student responsibilities</td><td colspan="6">Class attendance. Finished project task.</td></tr>
<tr><td rowspan="6">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>1</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>1</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Lab exercises</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1</td><td></td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td>2</td><td>(Other)</td><td></td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Continuous assessment is carried out during lectures, seminars and through consultations with regard to resolving project issues. The project task, preliminary sailboat design, is submitted in digital form. Examination: oral presentation of the project.</td></tr>
<tr><td rowspan="4">Required literature (available in the library and via other media)</td><td colspan="2">Title</td><td>Number of copies in the library</td><td colspan="2">Availability via other media</td></tr>
<tr><td colspan="2">Hamlin C. Preliminary Design of Boats and Ships. Cornell Maritime Press, 1989.</td><td>1</td><td colspan="2"></td></tr>
<tr><td colspan="2">Larsson L, Eliasson ER. Principles of Yacht Design. Adlard Coles Nautical, 2000. ISBN 0-7136-5181-4.</td><td>2</td><td colspan="2"></td></tr>
<tr><td colspan="2"></td><td></td><td colspan="2"></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">– Fossati F. Aero-hydrodynamics and the Performance of Sailing Yachts: The Science Behind Sailing Yachts and Their Design. Adlard Coles Nautical, 2009. ISBN-10: 1408113384.
– Doane CJ. The Modern Cruising Sailboat: A Complete Guide to Its Design, Construction and Outfitting. McGraw-Hill, 2009. ISBN 978-0-07-147810-6.
– Estes C.W. 3D modeling for the Marine industry.
– Spectre P.H. 100 boats design reviewed.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">The annual analysis of examination efficacy. Student survey in order to evaluate teachers. Self-evaluation of teachers. Feedback from students who have already graduated from the relevance of the course content.

Occasionally, observation and evaluation of teaching by the Head of Naval Architecture Department.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6">Available in English language.</td></tr>
</table>

NAME OF THE COURSE		Vibrations and vibration control					
Code	FESN23	Year of study	2				
Course teacher	Željan Lozina	Credits (ECTS)	5				
Associate teachers	Damir Sedlar Ivan Tomac	Type of instruction (number of hours)	P	S	AE	LE	CE
			30	0	30	0	0
Status of the course	Elective	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Develop understanding basics of electromechanical systems as well as capacity for modelling and implementation of electromechanical systems.		
Course enrolment requirements and entry competences required for the course	None		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: – explain basics and apply basic signal processing – Explain and apply sensors of position, displacement, velocity acceleration and force. – Explain basics and practically implement electro mechanic actuators and motors. – analyze electromechanical system with negative loopback – implement model of electromechanical system in time and frequency domain as well as in state space – perform simple identification of the system – perform measurement using software for measurement (LabVIEW) – analyze and apply simple control system (PID controller)		
Course content broken down in detail by weekly class schedule (syllabus)	Content	L hours	AE hours
	Signal processing basics.	2	2
	Sensors od position, displacement, velocity, acceleration and force (LVDTs, encoders, velometers, accelerometers, eddy current sensors and switches,…	2	2
	Electrodynamic actuators and motors and control of actuators and motors.	2	2
	Model of electromechanical system in time.	2	2
	Analytical mechanics approach.	2	2
	Lagrange equations.	2	2
	Concept of direct, indirect and inverse analysis.	2	2
	State space.	2	2
	Systems with negative loopback. Analysis of accuracy and stability.	2	2
	System Identification.	2	2
	Frequency domain analysis.	2	2
	Concept of direct indirect and inverse analysis.	2	2
	Analysis of selected system.	2	2

<table>
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<tr><td>Student responsibilities</td><td colspan="6">Class attendance.</td></tr>
<tr><td rowspan="5">Screening student work (name the proportion of ECTS credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)</td><td>Class attendance</td><td>2</td><td>Research</td><td>1</td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td>Individual work</td><td>2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td></td><td>Lab exercises</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td>1</td><td>(Other)</td><td></td></tr>
<tr><td>Written exam</td><td></td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="6">Continuous assessment during class. Exam: individual and group. Exam: the theoretical and practical (application software). Examination: oral (presentation of tasks assigned for independent work and discussion about research related to the topic of the tasks).</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td colspan="3">Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td colspan="3">Handouts</td><td></td><td>e-learning</td></tr>
<tr><td colspan="3">e-learning portal</td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="6">– S. Cetinkunt: Mechatronics, John Wiley and Sons, 2007.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="6">The annual analysis of examination efficacy. Student survey in order to evaluate teachers. Self-evaluation of teachers. Feedback from students who have already graduated from the relevance of the course content.
Occasionally, observation and evaluation of teaching by the Head of Naval Architecture Department.</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="6">Available in English language.</td></tr>
</table>