DETAILED PROPOSAL OF THE STUDY PROGRAMME

UNDERGRADUATE UNIVERSITY STUDY IN NAVAL ARCHITECTURE

Split, February 2022

1.1. List of mandatory and elective courses

List of courses								
Year of study: 1.								
Semester: I.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FEMX01	Mathematics 1	45	0	45	0	0	7
	FESD01	Ship Geometry	30	0	0	30	0	5
	L = Lectures, S = Seminar, AE = Auditory Exercises, LE = Laboratory Exercises, DE = Design Exercises							

List of courses								
Year of study: 1.								
Semester: II.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FEMX02	Mathematics 2	45	0	45	0	0	7
	FESC05	Material Mechanics 1	45	0	30	0	0	6
	L = Lectures, S = Seminar, AE = Auditory Exercises, LE = Laboratory Exercises, DE = Design Exercises							

List of courses								
Year of study: 2.								
Semester: III.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
	FESD02	Introduction to Thermodynamics	45	0	30	0	0	7
	FESC23	Computer Aided Design	30	0	0	0	30	5
	FESC08	Mechanics of Materials 2	30	0	30	0	0	5
	L = Lectures, S = Seminar, AE = Auditory Exercises, LE = Laboratory Exercises, DE = Design Exercises							

List of courses								
Year of study: 2.								
Semester: IV.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FETD04	Fundamentals of Manufacturing Processes	45	0	0	15	0	6
	FESD25	Ship Hydrostatics and Stability	45	0	30	0	0	6
	FESD10	Ship Equipment	30	0	0	0	0	2
	L = Lectures, S = Seminar, AE = Auditory Exercises, LE = Laboratory Exercises, DE = Design Exercises							

List of courses								
Year of study: 3.								
Semester: V.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FESD07	Ship Resistance and Propulsion	45	0	30	15	0	7
	FESD05	Ship Structural Design	45	0	45	0	0	7
	FENC01	Electrical Engineering and Electronics	30	0	15	15	0	4
	L = Lectures, S = Seminar, AE = Auditory Exercises, LE = Laboratory Exercises, DE = Design Exercises							

List of courses								
Year of study: 3.								
Semester: VI.								
STATUS	CODE	COURSE	HOURS IN SEMESTER					ECTS
			L	S	AE	LE	DE	
Mandatory	FESD12	Shipbuilding Technology	45	0	15	30	0	7
	FETD06	Shipyard Organization and Management	30	0	30	0	0	5
	FESD24	Preliminary Ship Design	15	0	0	15	30	5
	L = Lectures, S = Seminar, AE = Auditory Exercises, LE = Laboratory Exercises, DE = Design Exercises							

1.2. Course description

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">MATHEMATICS 1</td></tr>
<tr><td>Code</td><td>FEMX01</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>Ivan Slapničar, Ph.D., Full Professor,
Anita Matković, Ph.D., Associate Professor,
Josipa Barić, Ph.D., Assistant Professor.</td><td>Credits (ECTS)</td><td colspan="5">7</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Ph.D. Nevena Jakovčević Stor, Irena Bego, Anita Carević, Marija Čatipović, Lea Dujić, Ivana Grgić, Lana Periša, Marina Mandić, Dajana Radišić, Mirjana Strukan, Stjepan Vedran Vukasović, Vanja Županović.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>45</td><td>0</td><td>45</td><td>0</td><td>0</td></tr>
<tr><td>Status of the course</td><td>obligatory</td><td>Percentage of application of e-learning</td><td colspan="5">10</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- application of mathematical concepts and tools from the area of linear algebra, vector calculus, analytic geometry, diferential calculus, analysis of real functions of real variable, sequences and series of numbers and functions, to solving engineering problems.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Good knowledge of High School mathematics and passed State Exam in Mathematics.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to:
- state definitions and theorems from the enitre course,
- reproduce proofs of basic theorems,
- illustrate theorems with examples,
- solve systems of linear equations,
- apply vector calculus to analytical geometry of space,
- interpret derivatives mathematically, geometrically and physically,
- analyse functions of one variable,
- test convergence of sequences and series of numbers and functions.</td></tr>
<tr><td rowspan="5">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L or S hours</td><td>AE hours</td></tr>
<tr><td colspan="4">1. Introduction. Relations. Functions. Sets of numbers, complex numbers, trigonometric form of complex number, Moivre formulas.</td><td>3</td><td>3</td></tr>
<tr><td colspan="4">2. Matrices. Basic operations with matrices. Matrix formulation of system of linear equations. Gaussian elimination. Linear independence and rank of a matrix. Kronecker-Capelli theorem.</td><td>3</td><td>3</td></tr>
<tr><td colspan="4">3. Inverse matrix. Determinants. Submatrices and subdeterminants. Laplace expansion of a determinant. Cramer's rule.</td><td>3</td><td>3</td></tr>
<tr><td colspan="4">4. Vectors. Basic operations with vectors. Coordinate system. Unit vector and cosines of directions. Linear independence of</td><td>3</td><td>3</td></tr>
</table>

	vectors and basis of a space. Scalar (dot) product, vector product and mixed product.		
	5. Equations of a line. Equations of a plane. Applications of analytic geometry.	3	3
	6. Functions of a real variable: defining function, classification of functions. Limits and continuity. Asymptotes. Review of elementary functions.	3	3
	7. Derivatives. Tangent and normal. Differential and approximate computation.	3	3
	8. Higher derivatives and differentials. Derivatve of a parametric function. Theorems of differential calculus (Fermat, Rolle, Cauchy, Lagrange). L'Hospital's rule and limits of undetermined forms.	3	3
	9. Monotonicity. Necessary and sufficient conditions for extrema. Geometrical extrema.	3	3
	10. Curvature. Sufficient condition for convexity and concavity. Necessary and sufficient conditions for inflection points. Examining functions and drawing graphs.	3	3
	11. Sequences of real numbers. Basic inequality of convergence. Accumulation point and sub-sequence. Boundedness, monotonicity and convergence. Properties of limits. Cauchy series. Some important limits.	3	3
	12. Series of real numbers. Sufficient condition for convergence. Convergence criteria. Absolute convergence. Alternating series.	3	3
	13. Sequences of functions. Series of functions. Power series and convergence radius. Differentiating series of functions. Taylor series and applications.	3	3
	List of laboratory or design exercises		LE or DE hours

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

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	3	Research		Practical training	
	Experimental work		Report		Self study	3.6
	Essay		Seminar essay		(Other)	
	Tests	0.2	Oral exam		(Other)	
	Written exam	0.2	Project		(Other)	

Grading and evaluating student work in class and at the final exam	During semester two mid-term exams are held. The first exam is scheduled after 7 weeks of lectures, and the second in the week following the lectures. At each mid-term exam students can get 40 points, while the remaining 20 points are attained through assignements during lectures and excercises. The condition for passing the course is minimum 20 points on each mid-term exams and a total of at least 50 points. After semester, two final exams and a correction exam are held. Students which did not pass one mid-term exam, can take only this part of the exam during final exams.

<table>
<tr><td></td><td colspan="3">Student which did not pass any mid-term exam, take the final exam with comprehensive course content. In that case, masimum numbers of available points is 80. The condition for passing the course is minimum 40 points in the final exam and a total of at least 50 points. The grade is formed after the second final exam according to article 75 of the Statute of FESB:
15% of the best students get the mark excellent (5),
next 35% students get the mark very good (4),
next 35% students get the mark good (3), and
the last 15% students get thet mark sufficient (2).

Students who did not pass the course after final exams, and have obtained total of at leat 10 points, can attend the correction exam. On the correction exam maximal number of points is 100, and the minimum requirement for a passing grade is 50 points.

Mid-term exams, final exams and correction exams are held according to the exam schedule.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>I. Slapničar, Matematika 1, FESB, Split, 2002.</td><td>20</td><td>http://www.fesb.unist.hr/mat1</td></tr>
<tr><td>I. Slapničar, J. Barić, M. Ninčević, Matematika 1 – zbirka zadataka, FESB, Split, 2010.</td><td>20</td><td>http://www.fesb.unist.hr/mat1</td></tr>
<tr><td>Lecture materials on FESB e-learning portal.</td><td></td><td>httpd://elearning.fesb.unist.hr</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- Petar Javor, Matematička analiza 1, Element, Zagreb, 2001.
- Luka Krnić i Zvonimir Šikić, Račun diferencijalni i integralni, I. dio, Školska knjiga, Zagreb, 1993.
- S. Pavasović i ostali, Matematika - riješeni zadaci, Građevinski fakultet, Split, 1999.
- B. P. Demidovič, Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1995.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- homework
- short tests
- quizzes
- mid-term exams
- final exam
- student questionnaires</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	SHIP GEOMETRY						
Code	FESD01	Year of study	1				
Course teacher	Dario Ban, Ph. D., Assistant Professor	Credits (ECTS)	5				
Associate teachers	Josip Bašić, Teaching assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	30	0
Status of the course	Mandatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: learning about basic ship terminology, her geometry of outer and inner compartments, together with applying mathematical methods and tools for manual and computer based drawing of 2D and 3D ship hull geometry.
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: - Write basic terminology of ship as technical object. - Correct use of basic terminology in ship geometry. - Tell basic mathematical methods for ship geometry description. - Describe and apply the procedure for development of technical lines plan drawing. - Apply computer program for 3D drawing of D ship hull form (project).

Course content broken down in detail by weekly class schedule (syllabus)

Course content	L or S hours	AE hours
On ship geometry.	2	
Basic terminology about Ship hull form.	2	
Representation of ship's hull forms.	2	
Ship hull form coefficients.	2	
Basic properties of ship hull forms.	2	
Modification of Ship hull forms. Affine and non-affine transformations.	2	
3D ship hull form representation.	2	
Mathematical description of hull forms.	2	
Polynomial description of hull forms.	2	
Geometric properties of curves and surfaces.	2	
The description of hull forms using spline curves.	2	
The description of hull forms using B-spline and NURB-spline curves.	2	
3D parametric description of ship hull forms. The conditions for existance of developable surfaces.	2	
List of laboratory or design exercises		LE or DE hours
Project. Exercises with independent assignments.		30

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

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		Practical training	
	Experimental work		Report		Individual work	0.5
	Essay		Seminar essay	0.5	Design exercises	1
	Tests		Oral exam		(Other)	
	Written exam	1	Project	1	(Other)	

Grading and evaluating student work in class and at the final exam	

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Ban D. Geometrija broda. Internal script-unpublished (Croatian).		https://elearning.fesb.unist.hr
	Grubišić I. Geometrija broda. Digital udžbenik, FSB Zagreb.		www.fsb.hr/geometrija.broda/
	Blagojević B. Modeliranje forme broda pomoću računala. Materials for exercises, 2011.		https://elearning.fesb.unist.hr
	Lipschutz M. Differential Geometry. Schaum's Outline Series, McGraw-Hill, Inc.		

Optional literature (at the time of submission of study programme proposal)	- Markovina R. Geometrija broda. Internal script-unpublished (Croatian). - Maxsurf User Manual. Bentley Engineering, 2016.
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)	

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">MATHEMATICS 2</td></tr>
<tr><td>Code</td><td>FEMX02</td><td>Year of study</td><td colspan="5">1</td></tr>
<tr><td>Course teacher</td><td>Ivan Slapničar, Ph.D., Full Professor,
Anita Matković, Ph.D., Associate Professor,
Josipa Barić, Ph.D., Assistant Professor.</td><td>Credits (ECTS)</td><td colspan="5">7</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Ph.D. Nevena Jakovčević Stor, Irena Bego, Anita Carević, Marija Čatipović, Lea Dujić, Ivana Grgić, Lana Periša, Marina Mandić, Dajana Radišić, Mirjana Strukan, Stjepan Vedran Vukasović, Vanja Županović.</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>45</td><td>0</td><td>45</td><td>0</td><td>0</td></tr>
<tr><td>Status of the course</td><td>obligatory</td><td>Percentage of application of e-learning</td><td colspan="5">10</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- application of mathematical concepts and tools from the area of integral calculus, ordinary differential equations, functions of several variables and multiple integrals, to analyze and solve engineering problems.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Good knowledge of High School mathematics and passed State Exam in Mathematics.</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to:
- state definitions and theorems from the enitre course,
- reproduce proofs of basic theorems,
- illustrate theorems with examples,
- identify integrals which are elementary integrable and solve them.
- solve ordinary differential equations and systems of differential equations.
- apply differential equations to model population growth, heat conduction, the oscillator and the predator-prey system.
- identify quadratic surfaces
- analyze the extrema of real functions of several variables.
- apply a single and multiple definite integrals to computation of area, curve length, volume and center of gravity in the standard coordinate systems.</td></tr>
<tr><td rowspan="6">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L or S hours</td><td>AE hours</td></tr>
<tr><td colspan="4">1. Indefinite integrals. Definition and basic properties. Table of basic integrals. Basic techniques of integration.</td><td>3</td><td>3</td></tr>
<tr><td colspan="4">2. Integration of rational functions. Integration of trigonometric functions. Recursive formulae.</td><td>3</td><td>3</td></tr>
<tr><td colspan="4">3. Integration of some irrational functions. Integrating a series of functions. Application of integrals to free fall with air resistance problem.</td><td>3</td><td>3</td></tr>
<tr><td colspan="4">4. Definite integrals. Definition and basic properties. Newton-Leibnitz formulae. Techniques of integration. Improper integrals.</td><td>3</td><td>3</td></tr>
<tr><td colspan="4">5. Application of definite integrals - the length of arc planar curve, volume and surface area of the rotating body. Numerical integration – trapezoid rule, Simpson’s rule, Richardson extrapolation.</td><td>3</td><td>3</td></tr>
</table>

	6. The functions of several variables. Definition and basic properties. Domain of the function. Limits and continuity. Quadratic surfaces.	3	3
	7. Partial derivatives. Differentiability. Tangent plane. Extrema of functions of several variables. Conditional extrema.	3	3
	8. Multiple integrals. Basic concepts and definitions. Double integral. Double integral in polar coordinates. Applications of double integral.	3	3
	9. Triple integral. Triple integral in cylindrical and spherical coordinates. Change of variables in multiple integrals.	3	3
	10. Introduction to Differential Equations. Basic concepts and definitions. Examples: modeling population growth, logistic equation, equation of heat conduction, Hooke's law. Equations with separable variables.	3	3
	11. Homogeneous differential equations. Exact differential equations. Integration factor. Linear differential equations of the first order.	3	3
	12. Bernoulli differential equation. Euler method as numerical procedure for solving linear differential equations. Differential equations of second order.	3	3
	13. Linear differential equations of second order with constant coefficients. Example: electronic circuits - harmonic oscillator. Systems of differential equations. Lotka-Volterra equations for predator-prey system.	3	3
	List of laboratory or design exercises		LE or DE hours

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

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	3	Research		Practical training	
	Experimental work		Report		Self study	3.6
	Essay		Seminar essay		(Other)	
	Tests	0.2	Oral exam		(Other)	
	Written exam	0.2	Project		(Other)	
Grading and evaluating student work in class and at the final exam	During semester two mid-term exams are held. The first exam is scheduled after 7 weeks of lectures, and the second in the week following the lectures. At each mid-term exam students can get 40 points, while the remaining 20 points are attained through assignements during lectures and excercises. The condition for passing					

<table>
<tr><td></td><td colspan="3">the course is minimum 20 points on each mid-term exams and a total of at least 50 points.
After semester, two final exams and a correction exam are held.
Students which did not pass one mid-term exam, can take only this part of the exam during final exams.

Student which did not pass any mid-term exam, take the final exam with comprehensive course content. In that case, maximum numbers of available points is 80. The condition for passing the course is minimum 40 points in the final exam and a total of at least 50 points. The grade is formed after the second final exam according to article 75 of the Statute of FESB:
15% of the best students get the mark excellent (5),
next 35% students get the mark very good (4),
next 35% students get the mark good (3), and
the last 15% students get thet mark sufficient (2).

Students who did not pass the course after final exams, and have obtained total of at least 10 points, can attend the correction exam. On the correction exam maximal number of points is 100, and the minimum requirement for a passing grade is 50 points.

Mid-term exams, final exams and correction exams are held according to the exam schedule.</td></tr>
<tr><td rowspan="6">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>I. Slapničar, Matematika 2, skripta, FESB, Split</td><td></td><td>http://www.fesb.unist.hr/mat2</td></tr>
<tr><td>Lecture materials on FESB e-learning portal.</td><td></td><td>https://elearning.fesb.unist.hr</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- Petar Javor, Matematička analiza 2, Element, Zagreb, 2000.
- Luka Krnić i Zvonimir Šikić, Račun diferencijalni i integralni, I. dio, Školska knjiga, Zagreb, 1993.
- B. P. Demidovič, Zadaci i riješeni primjeri iz više matematike s primjenom na tehničke nauke, Tehnička knjiga, Zagreb, 1995.
- Dž. Lugić, Matematika II: metodički riješeni zadaci i kratki pregled definicija i teorema, FESB, 1999.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- homework
- short tests
- quizzes
- mid-term exams
- final exam
- student questionnaires</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	MECHANICS OF MATERIALS 1						
Code	FESC05	Year of study	1.				
Course teacher	Frane Vlak, Ph.D., Associate Professor	Credits (ECTS)	6				
Associate teachers	Marko Vukasović, Ph.D., Teaching assistant Branka Bužančić Primorac, Ph.D., Teaching assistant Maja Kovačić, Teanhing assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			45	0	30	0	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and application of basic laws of solid body mechanics, - introducing to stress and strain distribution in the beams under different types of loading (axial, torsion, bending, shear and combined loading).		
Course enrolment requirements and entry competences required for the course	Statics (Mechanics 1)		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - explain plane stress, plane strain and stress-strain relationship (Hooke's law), - analyse plane stress using Mohr's circle, - calculate geometrical properties of cross sections, - determine stress and displacements of beams under tension/compression, torsion and bending, - apply developed procedures to analyse and design simple structures (allowable stress and strain design), - solve statically indeterminate problems using the method of integration of the deflection curve and the method of equating displacements , - analyse beams under combined loadings using failure theories, - solve simple problems of buckling of columns.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Introduction to mechanics of materials. Problems and methods of mechanics of materials. Modelling of structures. Stress vector, normal and shear stress. Stress tensor. Stress transformation.	3	2
	Principal stresses. Mohr's circle for plane stress. Strain, normal strain, shear strain and dilatation. Strain tensor. Strain transformation. Mohr's circle for plane strain.	3	2
	Stress-strain relationship. Experimental data for technical materials.Hooke's law for uniaxial stress state. Plane stress state. Relationship between elasticity constants. Relationship between internal force components and stress components. General approach to problems of mechanics of materials.	3	2
	Geometrical properties of plane areas, first and second moment of area. Parallel axis theorem. Transformation of second moments of area under rotation of coordinate system. Mohr's circle for second moments of area. Radius of gyration.	3	2
	Tension/compression. Prismatic beams and beams with varying cross sectional area. Displacement diagram. Stress concentration.	3	2

	Torsion of circular beams. Assumptions and constraints. Shear stress and strain. Allowable stress design. Bending. Assumptions and constraints.	3	2
	Pure bending. Transverse bending. Allowable stress design. Unsymmetric bending.	3	2
	First midterm exam		
	Differential equation of the deflection curve. Moment-area method. Stresses and strains of beams with nonuniform cross sections.	3	2
	Bending of thick curved beams. Shear. Influence of the shear on beam deflection.	3	2
	Statically indeterminate problems in tension/compression. Thermal effects, misfits and prestrains. Statically indeterminate problems in torsion. Statically indeterminate problems in bending.	3	2
	Strain energy. Failure theories.	3	2
	Failure theories for combined loading problems.	3	2
	Buckling of columns. Elastic and inelastic buckling. Design formulas for columns.	3	2
	Second midterm exam		

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☐ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.	

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	2,5	Research		Practical training	
	Experimental work		Report		Individual work	3,2
	Essay		Seminar essay		Laboratory exercises	
	Tests	0,2	Oral exam		Preparation for laboratory exercises	
	Written exam	0,1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. Grade (in percentage) is formed according to the formula: Grade(%) = 0,5 (M1 + M2) the activities in percentage: • M1, M2 – test results.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Alfirević, I: Nauka o čvrstoći I, Tehnička knjiga, Zagreb, 1989.	5	
	F. Vlak: Autorizirana predavanja, FESB		e-learning portal

Optional literature (at the time of submission of study programme proposal)	Craig, R., R.: Mechanics of Materals, John Wiley & Sons, New York, 2000.
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	**INTRODUCTION TO THE THERMODYNAMICS**						
Code	FESD02	Year of study	2				
FESC06	Nižetić Sandro, Ph. D., Associate Professor	Credits (ECTS)	7				
Nižetić Sandro Ivan Tolj Dario Bezmalinović Grubišić-Čabo Filip	Ivan Tolj, Ph. D., Teaching assistant Dario Bezmalinović, Ph. D., Teaching assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			45	30	0	0	0
	Obligatory	Percentage of application of e-learning					
Obavezni							
Course objectives	Training students for: - Specify (list) basic thermodynamic terms and notations and apply general thermodynamic laws.						
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: - Classify and consider; basic thermodynamic terms, external influences and properties of state and connect them with causal relationship for considered property or analysed system, - Describe and implement general thermodynamic laws for specific properties or systems, - Implement thermodynamic charts for real properties to calculate their properties of state (values), - Consider and compute; flow systems, right and left ideal gas cycles and calculate heat to work efficiency, - Consider maximal work and calculate exergy flows.						

Course content broken down in detail by weekly class schedule (syllabus)	Course content				L or S hours	AE hours
	Introduction to the thermodynamics. External influences. Temperature, pressure and heat. Observer's aspect.				3 hours	2 hours
	Ideal gas equation and ideal gas mixtures.				3 hours	2 hours
	Equivalency of heat and work.				3 hours	2 hours
	Internal energy and First law of thermodynamics.				3 hours	2 hours
	Equilibrium polytropes.				3 hours	2 hours
	Ideal gas cycles and implementation of polytropes.				3 hours	2 hours
	Second law of thermodynamics.				3 hours	2 hours
	Analytical formulation of the second law of thermodynamics for reversible and irreversible processes.				3 hours	2 hours
	Entropy and statistical interpretation.				3 hours	2 hours
	Maximal work.				3 hours	2 hours
	Flow processes and implementation.				3 hours	2 hours
	Exergy analysis.				3 hours	2 hours
	Real properties, properties charts, Clapeyron-Clausiusova equation, Van der Waalsova equation.				3 hours	2 hours
	Properties curves for real gases, real gas power cycles.				3 hours	2 hours
	Left right cycles, refrigeration cycles and gas liquefaction.				3 hours	2 hours
Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work			☒ independent assignments ☒ multimedia ☐ laboratory ☐ work with mentor ☐ (other)		
Student responsibilities	The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required auditorium exercises.					
Screening student work *(name the proportion of ECTS*	Class attendance	2,5	Research	4,5	Practical training	
	Experimental work		Report		(Other)	

credits for each activity so that the total number of ECTS credits is equal to the ECTS value of the course)	Essay		Seminar essay		(Other)	
	Tests		Oral exam		(Other)	
	Written exam		Project		(Other)	
Grading and evaluating student work in class and at the final exam						

	Title	**Number of copies in the library**	**Availability via other media**
Required literature (available in the library and via other media)	Nižetić, S. : Online predavanja dostupna na E-learning portalu, (2010)		
	Bošnjaković F.: Nauka o toplini I, tehnička knjiga, Zagreb 1978.	2	
	Y. A. Cengel, M.A.Boles, Thermodynamics, 4th Edition,McGrawHill, 2002.	1	
	Fabris O: Osnove inženjerske termodinamike, Pomorski fakultet u Dubrovniku, Dubrovnik 1994.		

Optional literature (at the time of submission of study programme proposal)	–Ražnjević K.: Toplinske tablice, Aksiom, Zagreb 2000. –Paić M.: Toplina i termodinamika, školska knjiga, Zagreb 1994. –Zemansky, M.W., Dittman B.H.: heat and Thermodynamics, McGraw Hill Book Company, London 1987. –Ninić N.: Uvod u termodinamiku i njene tehničke primjene, Sveučilište u Splitu, FESB, (2008) – Baehr H.D.: Thermodynamik, Springer Verlag. Berlin 1984.
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results in accordance with the above learning outcomes - Feedback from students via surveys - Self-evaluation of teachers - Institutional and non-institutional evaluations
Other (as the proposer wishes to add)	

NAME OF THE COURSE	COMPUTER AIDED DESIGN						
Code	FESC23	Year of study	2				
Course teacher	Gojko Magazinović, Ph. D., Full Professor	Credits (ECTS)	5				
Associate teachers	-	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	0	0	30
Status of the course	Obligatory	Percentage of application of e-learning	50				

COURSE DESCRIPTION

Course objectives	Training students for: - understanding and application of basic terms and principles of feature-based modeling, parametric modeling, and geometric modeling, - ability to build simple models, assemblies, and technical drawings by using a geometric modeling tool, - ability to solve simple engineering problems by using a spreadsheet tool.		
Course enrolment requirements and entry competences required for the course	Passed Mathematics 1 exam.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - explain fundamental principles of geometric modeling, parametric modeling, and feature based modeling, - describe an importance and available approaches to the exchange of design data between the different CAD systems, - use a computer aided design tool, - construct simple geometric models and assemblies, - solve simple engineering problems by using a spreadsheet tool, - draw a graph by using a spreadsheet tool, - calculate a surface area by using a Simpson's Rule.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Introduction to a course. Description of an e-learning portal.	2	
	Introduction to CAD/CAM/CAE systems, part I: applications; the expansion of 3D CAD technology; acquiring and installation of Creo Parametric computer program.	2	
	Introduction to CAD/CAM/CAE systems, part II.	2	
	Elements of CAD/CAM/CAE systems; hardware; software.	2	
	Geometric modeling; feature based modeling; parametric modeling.	2	
	CAD data structures; exchange of design data between the different CAD systems.	2	
	A brief on structural analysis.	2	
	First midterm exam		
	History of computing and computers; computer representation of numbers; engineering calculations.	2	
	„Handle numbers with care“: numerical examples; sample workbooks.	2	
	Graphical representation of engineering results.	2	
	Numerical integration; equations; systems of equations.	2	
	Applications: propeller mass moment of inertia	2	
	Applications: parametric curves; spline.	2	
	Second midterm exam		

	List of laboratory or design exercises	LE or DE hours
	The environment of CAD design tool; extrusion of a closed curve.	2
	Sketch tool; extrude; round; chamfer; hole; parameters.	2
	Revolving of a closed curve.	2
	Design planes.	2
	Sections; shells, constraints; sketching utilities.	2
	Making assemblies.	2
	Technical drawing preparation.	2
	Spreadsheet tool elements; making a simple worksheet; built-in functions.	2
	Absolute and relative cell addressing; complex expressions.	2
	Working with data series; conditional formatting; graphing.	2
	Numerical integration: trapezoidal and Simpson's rule.	2
	Equations.	2
	System of equations: linear systems; nonlinear systems.	2

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☒ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☒ computer work (other)
Student responsibilities	Attendance of at least 70% lectures and all design exercises.	

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	0,8
	Essay		Seminar essay		Computer work	2
	Tests	0,2	Oral exam		(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	There are two midterm exams during the semester (carried out by using computer and e-learning portal; 90 minutes duration; first exam: 17 theoretical questions and two design problems; second exam: five theoretical questions and three numerical problems). The final exams attend students that didn't pass the midterm exams. The requirements for passing grade are the fulfillment of student responsibilities and at least 50% points on each midterm exam or the final exam. Grade (in percentage) is determined as follows: Grade(%) = (M1 + M2)/2 where M1 and M2 are the midterm grades. The final grades are: satisfactory (2), grades from 50% to 61%; good (3), grades from 62% to 74%; very good (4), grades from 75% to 87%; and excellent (5), grades from 88% to 100%.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	G. Magazinović, Bilješke uz predavanja, FESB	-	e-learning portal
	R. Toogood: Creo Parametric 2.0 Tutorial and Multimedia DVD, SDC Publications, Mission, 2013.	1	https://books.google.hr

	B. Plazibat, i drugi: Informatika 1, Sveučilišni studijski centar za stručne studije, Split, 2010.	-	Link at e-learning portal
Optional literature (at the time of submission of study programme proposal)	- K. Lee: Principles of CAD/CAM/CAE Systems, Addison-Wesley, Reading, 1999. - C. McMahon, J. Browne: CADCAM: Principles, Practice and Manufacturing Management, Prentice-Hall, Harlow, 1998.		
Quality assurance methods that ensure the acquisition of exit competences	- Evaluation of results by the above learning outcomes - Feedback from students via surveys - Institutional and non-institutional evaluations		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	**MECHANICS OF MATERIALS 2**						
Code	FESC08	Year of study	2.				
Course teacher	Frane Vlak, Ph.D., Associate Professor	Credits (ECTS)	5				
Associate teachers	Marko Vukasović, Ph.D., Teaching assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	30	0	0
Status of the course	Obligatory	Percentage of application of e-learning	0				
COURSE DESCRIPTION							
Course objectives	Training students for: - understanding and application of basic laws of structural analyses, - introducing to energy methods: the force method, the displacement method and method of initial parameters, - introducing to thin circular plates analysis.						
Course enrolment requirements and entry competences required for the course	Statics (Mechanics 1) and Mechanics of Materials 1.						
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - explain generalized force and displacement, flexibility and stiffness matrix, strain energy of beams, - explain Betti's theorem, Maxwell's theorem, Castigliano's theorems and theorems of minimum potential energy - apply Castigliano's theorems to plane beam structures (frames), - determine statical and kinematical indeterminancy of beam structures, - combine symmetry and antisymmetry of beam structures, - explain basic system of the force method and the canonical equations of the force method , - apply the force method to beam structures,						

<table>
<tr><td></td><td colspan="3">- explain basic system of the displacement method and the canonical equations of the displacement method,
- apply the displacement method to beam structures,
- explain the method of initial parameters,
- apply the method of initial parameters in the analysis of the displacements and internal force components,
- calculate stresses and internal force components of thin circular plates.</td></tr>
<tr><td rowspan="16">Course content broken down in detail by weekly class schedule (syllabus)</td><td>Course content</td><td>L hours</td><td>AE hours</td></tr>
<tr><td>Work. Generalized force and displacement. Work-energy principle. Flexibility coefficients. Flexibility matrix. Stiffness coefficients. Stiffness matrix. Strain energy. Elastic strain energy for various types of loading. Clapeyron's theorem.</td><td>2</td><td>2</td></tr>
<tr><td>Betti's theorem. Maxwell's theorem. Castigliano's theorems. Mohr's integral. Vereschagin's rule. Theorem of minimum potential energy. Theorem of minimum complementary potential energy.</td><td>2</td><td>2</td></tr>
<tr><td>Types of beam structures. Degree of freedom. Statical indeterminancy. Kinematical indeterminancy.</td><td>2</td><td>2</td></tr>
<tr><td>Symmetry and antisymmetry of beam structures.</td><td>2</td><td>2</td></tr>
<tr><td>Basic system of the force method. Symmetrical basic systems.</td><td>2</td><td>2</td></tr>
<tr><td>Canonical equations of the force method.</td><td>2</td><td>2</td></tr>
<tr><td>Basic system of the displacement method.</td><td>2</td><td>2</td></tr>
<tr><td>First midterm exam</td><td></td><td></td></tr>
<tr><td>Symmetrical basic systems for displacement method.</td><td>2</td><td>2</td></tr>
<tr><td>Canonical equations of the displacement method.</td><td>2</td><td>2</td></tr>
<tr><td>Method of initial parameters. State vector. Field matrix. Load vector.</td><td>2</td><td>2</td></tr>
<tr><td>Several load distributions. Statical indeterminate problems.</td><td>2</td><td>2</td></tr>
<tr><td>Bending of thin circular plates.</td><td>2</td><td>2</td></tr>
<tr><td>Membrane stresses in axisymmetric shells. Thick walled pressure vessels.</td><td>2</td><td>2</td></tr>
<tr><td>Second midterm exam</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
☒ independent assignments
☒ multimedia
☐ laboratory
☐ work with mentor
☐ (other)</td></tr>
<tr><td>Student responsibilities</td><td colspan="3">The presence on lectures in the amount of at least 70 % of the times scheduled. Performed all required laboratory exercises.</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 colspan="3"><table>
<tr><td>Class attendance</td><td>2,0</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>2,2</td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>0,5</td><td>Laboratory exercises</td><td></td></tr>
<tr><td>Tests</td><td>0,2</td><td>Oral exam</td><td></td><td>Preparation for laboratory exercises</td><td></td></tr>
<tr><td>Written exam</td><td>0,1</td><td>Project</td><td></td><td>(Other)</td><td></td></tr>
</table></td></tr>
<tr><td></td></tr><tr><td></td></tr><tr><td></td></tr><tr><td></td></tr>
<tr><td>Grading and evaluating student work in class and at the final exam</td><td colspan="3">There are two midterms and final exams. The first midterm exam is after 7 weeks of lecturing and the second one is after the next 6 weeks. In the final exams students that did not pass the midterm exams take part. The midterm and final exams are carried out as written tests. Grade (in percentage) is formed according to the formula:</td></tr>
</table>

<table>
<tr><td></td><td colspan="3">Grade(%) = 0,45 (M1 + M2) + 0,1S
the activities in percentage:
• M1, M2 – test results,
• S - seminar essey.</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Alfirević, I.: Nauka o čvrstoći II, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje, Zagreb, 1999.</td><td>5</td><td></td></tr>
<tr><td>Pavazza, R.; Uvod u analizu tankostjenih štapova, Zagreb, 2007.</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">- Parnes, R.: Solid Mechanics, John Wiley & Sons, Chichester, 2001.
- Solecky, R., Conant, R. J.: Advanced Mechanics of Materials, Oxford University Press, New York, Oxford, 2003.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">FUNDAMENTALS OF MANUFACTURING PROCESSES</td></tr>
<tr><td>Code</td><td>FETD04</td><td>Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td>Nikša Krnić, PhD, Associate professor
Branimir Lela, PhD, Associate professor</td><td>Credits (ECTS)</td><td colspan="4">6</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Jure Krolo, Teaching Assistant
Domagoj Kojundžić, Teaching Assistant</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>45</td><td></td><td></td><td>15</td><td></td></tr>
<tr><td>Status of the course</td><td>Obligatory</td><td>Percentage of application of e-learning</td><td colspan="4">10%</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- obtaining a brief encyclopaedic overview of the basic production technologies and acquiring basic knowledge about the relationship among design, materials and technologies necessary for successful production in the field of shipbuilding and mechanical engineering
- acquiring basic knowledge about casting, forming by deformation, machining, metal joining and thermal cutting technologies and the application possibilities of these production processes for shipbuilding needs</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">None</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to:
- classify manufacturing technologies
- classify processes of casting, forming by deformation, chip forming machining, welding, brazing and soldering, thermal cutting
- analyse basic characteristics of individual mechanical engineering technologies
- demonstrate basic processes on available machines
- describe generally machines and equipment on which processes are carried out
- interpret the criteria for selection of manufacturing technologies/processes
- distinguish basic features of the processes with regard to processed material
- estimate the application of appropriate mechanical engineering technology/process to a specific product</td></tr>
<tr><td rowspan="10">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L hours</td><td>AE hours</td></tr>
<tr><td colspan="4">Importance and classification of metal forming processes. Concept of plastic deformation and indicators of ductility</td><td>3</td><td>/</td></tr>
<tr><td colspan="4">Changes in materials caused by deformation; Anisotropy; Strain and strain rate; Flow stress and flow curves</td><td>3</td><td>/</td></tr>
<tr><td colspan="4">Processes of upsetting, forging, drawing and extrusion</td><td>3</td><td>/</td></tr>
<tr><td colspan="4">Processes of rolling and sheet forming by bending, deep drawing and stamping</td><td>3</td><td>/</td></tr>
<tr><td colspan="4">Processes of chip forming machining; Motion of tool and workpiece; Basic geometry; Forming and shapes of chips; Materials for cutting tools; Quality of machined surface</td><td>3</td><td>/</td></tr>
<tr><td colspan="4">Methods of processing with defined cutting tool geometry; Turning, shaping, drilling, milling, broaching and sawing</td><td>3</td><td>/</td></tr>
<tr><td colspan="4">Methods of processing with undefined cutting tool geometry; Grinding, honing, lapping</td><td>2</td><td>/</td></tr>
<tr><td colspan="4">First midterm exam</td><td></td><td></td></tr>
</table>

	Casting principles; Casting models and moulds types (permanent and expendable), construction and main parts; Liquid metal flow in moulds; Solidification mechanisms. Cast microstructures and features.	3	/
	Overview of casting processes; Sand casting; shell casting; pressure die casting, centrifugal casting, continuous casting, strip casting; Castability tests; Casting defects. Recommendation for castings design.	4	/
	Basic principles of metal joining; Hazards and safe welding practice; Classification of welding processes; Power sources; Joints and welding positions; Oxy-fuel welding; Arc welding; Shielded metal arc welding	3	/
	Submerged arc welding; MAG welding; MIG welding; TIG welding; Plasma welding	3	/
	Laser welding; Electron beam welding; Hybrid laser-arc and other advanced welding processes	3	/
	Soldering; Adhesive joining; Thermal cutting; Gouging; Thermal spraying; Weldability; Welding discontinuities; Mech. properties and quality of welded joints	3	/
	Second midterm exam		
	List of laboratory exercises		LE hours
	Changes in material properties after upsetting; Determination of friction coefficient		1
	Cold and hot open-die forging		1
	Extrusion of section on lab hydraulic press		1
	Metal sheet forming by bending, deep drawing and spinning		1
	Turning		1
	Face and peripheral milling		1
	Shaping; Drilling; Grinding		1
	Shielded metal arc welding		1
	Submerged arc welding; MAG welding		1
	MIG welding; TIG welding		1
	Oxy-fuel welding; Brazing; Soldering		1
	Plasma arc cutting; Oxy-fuel cutting		1
	Gouging; Thermal spraying		1

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Student responsibilities	Presence at the lectures at least 70% and at the laboratory exercise 100% of the time scheduled. Preparation and submission of reports from laboratory exercises.	

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	2,5	Research		Practical training	
	Experimental work	0,5	Report		Individual work	3
	Essay		Seminar essay		Laboratory exercises	
	Tests		Oral exam		(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	During the semester there are two midterms and final exams. First midterm exam is after 7 weeks and the second is after 15 weeks of lectures. The requirements for a positive grade are 50% points on each midterm.

<table>
<tr><td></td><td colspan="3">Grade is forming in accordance with the following formula:
Grade (%)=(M1 + M2)/2
M1, M2 – score on midterms in percentage (%)

Grading policy:
Percentage Grade
50% do 61% sufficient (2)
62% do 74% good (3)
75% do 87% very good (4)
88% do 100% excellent (5)
Students who do not pass midterms attend regularly scheduled final written exam. The requirement for a positive grade on the final exam is to achieve 50% of overall points.

Examination terms: according to the timetable</td></tr>
<tr><td rowspan="5">Required literature (available in the library and via other media)</td><td>Title</td><td>Number of copies in the library</td><td>Availability via other media</td></tr>
<tr><td>Duplančić, I.; Krnić, N.; Bajić, D.: "Osnove tehnologija", autorizirana predavanja, FESB, Split 2005.</td><td></td><td>e-learning portal</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td colspan="3">– Kalpakjian S.: "Manufacturing Engineering and Technology", Addison - Wesley Publishing Company, 1989.Šavar,
– Duplančić, I.: Obrada deformiranjem, Sveučilište u Splitu, FESB, Split 2007.
– Math M., “Uvod u tehnologiju oblikovanja deformiranjem”, Sveučilište u Zagrebu, Fakultet strojarstva i brodogradnje, Zagreb, 1999.
– Gojić M.: “ Tehnike spajanja i razdvajanja materijala”, Sveučlište u Zagrebu, Metalurški fakultet Sisak, 2003
– Cebalo, R.: "Obrada odvajanjem čestica", obrađena pitanja i zadaci, Zagreb, 2000.
– Ekimović Š.: "Postupci obrade rezanjem”, Univerzitet u Sarajevu, mašinski fakultet u Zenici, 2003.
– Cebalo R.: "Obrada odvajanjem čestica, Podsjetnik za ispit i zadaci, FSB Zagreb, 1999.
– Bajić D.: "Obrada obrada odvajanjem čestica”, predavanja, FESB Split, 2005.
– R. Deželić, Osnove konstrukcijskih materijala, Sveučilište u Splitu, FESB Split, 1996.
– Deželić R., Metali II, FESB Split, 1987
– Stupnišek M., F. Cajner: Osnove toplinske obradbe materijala, Sveučilište u Zagrebu, Zagreb, 1996.
– S. Kralj i Š. Andrić: Zavarivanje i srodni postupci, FSB Zagreb 1999.
– N. Krnić: Zavarivanje – podloge s predavanja, neobjavljeno</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td colspan="3">- Keeping records of class attendance
- Evaluation of results in accordance with the learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td colspan="3"></td></tr>
</table>

NAME OF THE COURSE	SHIP HYDROSTATICS AND STABILITY						
Code	FESD25	Year of study	3				
Course teacher	Dario Ban, Ph. D., Assistant Professor	Credits (ECTS)	7				
Associate teachers		Type of instruction (number of hours)	L	S	AE	LE	DE
			45	0	45	0	0
Status of the course	Mandatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Training students for: learning basics about ship hydrostatics, the methods for calculation of hydrostatics properties and stability for intact and damaged ship, and the rules of classification societies for approval of ship stability 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: - Tell three basic conditions of floatation and identify ship hydrostatic properties. - Describe and apply numerical procedures for preparation of basic ship hydrostatic properties. - Compute intact ship stability properties. - Distinguish the methods for calculation of damage ship stability. - Calculate hydrostatics and stability of intact ship for defined loading conditions (project). - Apply classification societies rules for estimation of calculated ship intact stability results.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Archimed's law. Floatation conditions. The basics of ship's hydromechanics.	3	
	The calculation of hydrostatics characteristics of immersed ship hull.	3	
	Ship's centration. Inclination test. The effects of weight change or shift during loading/unloading on ship centre of gravity and her trim.	3	
	Bonjean curves plan. Hydrostatic particulars diagram.	3	
	Righting levers curve. Static stability, initial stability and metacenter.	3	
	Dynamic stability. Heeling moments.	3	
	Elementary stability curves. Metacentric curve. Curves of centers of buyancy. Waterlines curve.	3	
	The stability for large angles. Pantocarene isoclines. Unification of stability calculations.	3	
	Harmonic oscilator of one-degree.	3	
	The influence of free surface moment on ship stability.	3	
	IMO and Classification societies rules for stability.	3	
	Floodable lengths calculation.	3	
	Damage stability calculation. Grounding.	3	
	List of laboratory or design exercises		LE or DE hours
	Project.		45

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

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	2.5	Research	0.5	Practical training	
	Experimental work		Report		Individual work	2
	Essay		Seminar essay		(Other)	
	Tests		Oral exam		(Other)	
	Written exam	1	Project	1	(Other)	

Grading and evaluating student work in class and at the final exam			
Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Uršić J. Plovnost broda. FSB, Zagreb		
	Uršić J. Stabilitet broda I. FSB, Zagreb		
	Uršić J. Stabilitet broda II. FSB, Zagreb		

Optional literature (at the time of submission of study programme proposal)	- Kobylinski L., Kaster S. Stability and Safety of Ships, Elsevier, 2003. - Biran AB. Ship Hydrostatics and Stability. Butterworth-Heinemann 2003. - IMO ship stability rules A749(18).
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)	

NAME OF THE COURSE	SHIP EQUIPMENT						
Code	FESD10	Year of study	3				
Course teacher	Boris Ljubenkov, Ph. D., Associate Professor	Credits (ECTS)	2				
Associate teachers		Type of instruction (number of hours)	P	S	AE	LE	CE
			30	0	0	0	0
Status of the course	Mandatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Objective of the course is to introduce students with standard ship equipment which include outfits for anchoring, mooring, rescuing, steering, cargo handling, fire protection, navigation and ventilation.		
Course enrolment requirements and entry competences required for the course	Not exist.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	– Explain function and elements of equipment for steering, navigation and rescuing. – Explain function and elements of equipment for anchoring and mooring. – Explain function and elements of equipment for cargo handling of different kind of ships. – Explain function and elements of equipment for fire protection and ventilation. – Create documentation for sections and blocks outfitting. – Create ship outfitting plan according rules and regulations of the classification societies.		
Course content broken down in detail by weekly class schedule (syllabus)	Content	L hours	AE hours
	Introduction in ship equipment. Relations between shipbuilding technology, outfitting and organization.	2	
	Ship outfitting activities and organization. Traditional and modern method of ship outfitting. Outfitting phases and zones.	2	
	Ship functions. Design and economic demands for ship equipment.	2	
	Anchoring equipment. Elements, fabrication and assembly characteristics.	2	
	Mooring equipment. Elements, fabrication and assembly characteristics.	2	
	Rescuing equipment. Elements, fabrication and assembly characteristics.	2	
	Steering equipment. Elements, fabrication and assembly characteristics.	2	
	Liquid cargo handling equipment. Elements, fabrication and assembly characteristics.	2	
	Bulk cargo handling equipment. Elements, fabrication and assembly characteristics.	2	
	General cargo and container handling equipment. Elements, fabrication and assembly characteristics.	2	
	Fire protection equipment and equipment in refrigerant spaces. Elements, fabrication and assembly characteristics.	2	

	Ventilation, heating and air-conditioning equipment. Elements, fabrication and assembly characteristics.	2	
	Ship modular outfitting	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, tests and oral exam.	

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		Practical training	
	Experimental work		Report		Individual work	
	Essay		Seminar essay		Lab exercises	
	Tests		Oral exam	1	(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	Continuous assessment during class. Two tests during the semester. Examination: oral exam

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Markovina, R.: Suvremene metode opremanja broda – skripta- interno izdanje, FESB, 2012.		e-learning
	Čagalj, A.: Oprema broda – skripta, FESB – interno izdanje, 2012.		e-learning
	Ljubenkov, B.: Oprema i opremanje broda – sadržaj i redoslijed predavanja – FESB – interno izdanje, 2015.		e-learning

Optional literature (at the time of submission of study programme proposal)	– Vukičević, B.: Oprema broda, FSB, Zagreb, 1983. – Ozretić, V.: Brodski pomoćni strojevi i uređaji, Split Ship Management Ltd, Split, 1996. – Proceedings of the symposium SORTA – Journal Shipbuilding (Brodogradnja)
Quality assurance methods that ensure the acquisition of exit competences	Student survey in order to evaluate teachers. Occasionally, observation and evaluation of teaching by the Head of Naval Architecture Department.
Other (as the proposer wishes to add)	

NAME OF THE COURSE	SHIP RESISTANCE AND PROPULSION						
Code	FESD07	Year of study	3				
Course teacher	Branko Blagojević, Ph. D., Full Professor	Credits (ECTS)	7				
Associate teachers	Josip Bašić, Teaching assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			45	0	0	30	15
Status of the course	Mandatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Training students for: - Understanding of ship resistance and propulsion.		
Course enrolment requirements and entry competences required for the course	Ship geometry Fluid mechanics. Stability of ships. English language 1 and 2		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: - Explain origins of ship resistance components. - Compare empiric and numeric methods in calculation of ship resistance. - Select appropriate approach for power prediction and selection of main engine and propeller for a given ship. - Apply software for computational fluid dynamics on a given ship geometry.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Historic development of ship hydrodynamics. Ship resistance. Division of ship resistance to components. Similarity laws in ship hydrodynamics.	3	
	Overview of experimental methods for estimation of ship resistance. Model tests. Extrapolation of model test results. Correlation of resistance model-ship.	3	
	Basic equations of flow around ship hull. Friction resistance.	3	
	Boundary layer. Viscous resistance.	3	
	Surface waves in gravity field. Ship wave systems. Potential theory. Wave resistance.	3	
	Influence of depth on resistance. Other resistances. Empiric methods for calculation of ship resistance.	3	
	Numeric approach for prediction of ship resistance and flow.	3	
	Ship hull design from resistance viewpoint. Procedures for hull geometry improvement.	3	
	Components of propulsion power. Propulsion efficiency. Overview of types of propulsors. Hydrodynamic theory of propulsors.	3	
	Propeller design and strength. Calculation methods.	3	
	Wave. Cavitation. Model tests.	3	
	Power prediction procedure.	3	
	Power prediction procedure 2.Trial run.	3	
	List of laboratory or design exercises		LE or DE hours
	Procedures for estimation of resistance (using commercial software) and selection of propeller and main engine for a given ship. Individual assignments for CFD calculations (using commercial software).		45

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

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 assignments (Other)	3
	Essay		Seminar essay		(Other)	
	Tests		Oral exam	1	(Other)	
	Written exam	1	Project		(Other)	

Grading and evaluating student work in class and at the final exam	Continuous assessment on lectures, seminars and exercises. Assessment of individual tasks (oral exam). Written exam.		
Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Blagojević B. Ship hydrodynamics. Lectures. FESB, 2010.		online
Optional literature (at the time of submission of study programme proposal)	1. Vučinić A. Ship Hydrodynamics: Resistance. Sveučilište u Rijeci, Tehnički fakultet, 1997. 2. Van Lameren, W. P. A., "Resistance and propulsion of ships", Brodarski institut, Zagreb, 1952. 3. Molland. Ship Resistance and propulsion. 2010.		
Quality assurance methods that ensure the acquisition of exit competences	-		
Other (as the proposer wishes to add)			

<table>
<tr><td>NAME OF THE COURSE</td><td colspan="6">Ship Structural Design</td></tr>
<tr><td>Code</td><td>FESD05</td><td>Year of study</td><td colspan="4">2</td></tr>
<tr><td>Course teacher</td><td>Branko Blagojević</td><td>Credits (ECTS)</td><td colspan="4">7</td></tr>
<tr><td rowspan="2">Associate teachers</td><td rowspan="2">Paul Jurišić</td><td rowspan="2">Type of instruction (number of hours)</td><td>L</td><td>S</td><td>AE</td><td>LE</td><td>DE</td></tr>
<tr><td>45</td><td>0</td><td>0</td><td>0</td><td>45</td></tr>
<tr><td>Status of the course</td><td>Mandatory</td><td>Percentage of application of e-learning</td><td colspan="4">0</td></tr>
<tr><td colspan="7">COURSE DESCRIPTION</td></tr>
<tr><td>Course objectives</td><td colspan="6">Training students for:
- Understanding function of ship structural components and whole structure, structural design of modern merchant ships, scantlings calculation using the rules of classification societies and international regulations, and loads on ship structures.</td></tr>
<tr><td>Course enrolment requirements and entry competences required for the course</td><td colspan="6">Ship geometry
Mechanics 1
Mechanics of materials
English language 1 and 2</td></tr>
<tr><td>Learning outcomes expected at the level of the course (4 to 10 learning outcomes)</td><td colspan="6">Students will be able to:
– Illustrate design principles on examples.
– Determine scantling of structural components using the rules of classification societies and taking into account international regulations.
– Distinguish loads on ship structures.
– Explain procedure for calculation of longitudinal strength.
– Estimate wave loads for a given ship.
– Construct midship section and longitudinal cross-section for a given ship.</td></tr>
<tr><td rowspan="20">Course content broken down in detail by weekly class schedule (syllabus)</td><td colspan="4">Course content</td><td>L or S hours</td><td>AE hours</td></tr>
<tr><td colspan="4">The role of classification societies. International organizations and conventions. Technical rules. Technical documentation.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Basic terminology. Overview of ship types.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Basic building elements. Systems of structural arrangement. Entities of structural strength.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Overview of loads on ship structures. Overview of failure modes.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Bottom structure. Shell plating. Bulkheads.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Side structure. Framing. Deck structures. Hatches.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Structural tanks. Superstructure. Fore and aft structure.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Longitudinal strength.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Longitudinal strength.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Panel and girders.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Structural connections.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Fatigue strength.</td><td>3</td><td></td></tr>
<tr><td colspan="4">Overview of ship structural design approaches.</td><td>3</td><td></td></tr>
<tr><td colspan="5">List of laboratory or design exercises</td><td>LE or DE hours</td></tr>
<tr><td colspan="5">Project: for a given ship construct midship section and longitudinal cross-section using the rules of classification societies.</td><td>45</td></tr>
<tr><td colspan="5"></td><td></td></tr>
<tr><td colspan="5"></td><td></td></tr>
<tr><td>Format of instruction</td><td colspan="3">☒ lectures</td><td colspan="3">☒ independent assignments</td></tr>
</table>

	☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☒ field work	☐ multimedia ☐ laboratory ☐ work with mentor ☒ project (other)
Student responsibilities		

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 Assignment	2
	Essay		Seminar essay		(Other)	
	Tests		Oral exam		(Other)	
	Written exam		Project	3	(Other)	

Grading and evaluating student work in class and at the final exam	Continuous assessment on lectures, seminars and exercises. Assessment of individual assignments. Exam: project defence (oral exam). Theory (written exam). Grade: theory grade, quality of the project and oral defence grade, activity and knowledge on lectures, seminars and exercises.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Žiha K. Ship construction, FSB, Zagreb, 2010.		online
	Uršić J. Strength of ships I. FSB, Zagreb 1972.	3	
	B. Blagojević. Ship structural design. Lectures. FESB, 2014.		e-learning

Optional literature (at the time of submission of study programme proposal)	– Eyres DJ. Ship Construction. 7th ed. Butterworth-Heinemann, 2005. ISBN-10: 0750680709. – Grubišić M. Ship Construction. FSB Zagreb, 1980. – Hughes O, Paik JK. Ship Structural Analysis and Design. SNAME 2010. ISBN 978-0-939773-78-3.
Quality assurance methods that ensure the acquisition of exit competences	Student surveys. 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	ELECTRICAL ENGINEERING AND ELECTRONICS						
Code	FENC01	Year of study	3.				
Course teacher	Ivan Marinović, Ph.D., Full Professor Ivica Jurić-Grgić, Ph.D., Associate Professor	Credits (ECTS)	4				
Associate teachers	Duje Čoko,Ph.D,, Teaching assistant Nedjeljka Grulović–Plavljanić, Teaching assistant Ivan Krolo, Teaching assistant	Type of instruction (number of hours)	L	S	AE	LE	DE
			30	0	15	15	0
Status of the course	Obligatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Training students for: - application of basic principles and laws of electrical engineering, - setting up and solving simple electrical circuits, - permanent adoption of basic knowledge in the field of electrical machines, - thorough understanding of physical principles within semiconductors - basic digital and analog circuit analysis - application of Boolean algebra - understanding the basic functions of microcontroller 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: - definethe fundamental phenomena, the quantities and the laws of electrical engineering, - apply fundamental laws of electrical engineering for the calculation of electromagnetic quantities, - analyse simple electrical networks, - measure basic electrical values (current, voltage, resistance). - describe basic principles of electrical machines. - recognize basic analog and digital electronic circuits - DC and AC analysis of basic circuits incorporating diodes and transistors - solve Boolean algebra problems - understand the basic microcontroller system functions		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L hours	AE hours
	Electrostatics:electricity and physical property of matter;Coulomb's law;electric field; electric flux density, electrical work, electrostatic voltage,electrostatic potential, capacitance, capacitors, static electricity.	2	2
	DC currents: Electric circuits; electrical property of matter; Electrical conductivity and electrical resistance; voltage and current sources;Ohm's law; temperature dependence of electrical resistance; series, parallel and combination circuits; Kirchhoff's Laws; power and energy of DC current; circuit analysis techniques; electrolysis and chemical sources of electric current.	2	2

	Magnetism:Basics of magnetism; natural magnet and *electromagnet; magnetic flux; Faraday's law; magnetic forces on moving charges and on a current-carrying wire; magnetic force between two parallel current-carrying wires; Ampere's Law; toroidal solenoid.* Mutual and self inductance; leakage of magnetic flux; ferromagnetism; magnetic hysteresis; magnetic circuit; magnetic energy;magnetic force.	2	1
	AC currents: Current and voltage sinusoidal waveform;form and crest factor; generation of a voltage sinusoidal waveform;Euler's formula for complex numbers;phase relationships in AC Circuits; Ohm's law in complex form;resistive and reactive impedance in AC Circuits; series, parallel and combination AC circuits; circuit analysis techniques using complex numbers; power and energy of AC current;three-phase AC circuits.	2	2
	Transformers and synchronous machines	2	0
	Induction motors	2	0
	DC motors; universal motors.	2	0
	Semiconductors: diodes, transistors, thyristors	2	2
	Analog electronic circuits	2	2
	Digital electronic circuits	2	2
	Microprocessors	2	0
	Sensors and actuators	2	0
	Microprocessor-assisted control of processes and machines	2	0
	List of laboratory exercises		LE hours
	Series, parallel and combination DC circuits		2
	Resistive and reactive impedance in AC Circuits		2
	Power of AC current		2
	Open circuit test on transformer		2
	Basic diode circuits		2
	Basic transistor amplifiers		2
	Operational amplifier		2
	Logic gates, multiplexer, demultiplexer		1

Format of instruction	☒ lectures ☐ seminars and workshops ☒ exercises ☐ *on line* in entirety ☐ partial e-learning ☐ field work	☐ independent assignments ☒ multimedia ☒ laboratory ☐ work with mentor ☐ (other)
Studentresponsibilities	The presence on lectures in the amount of at least 70% of the times scheduled. Performed all required laboratory exercises.	

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

Grading and evaluating student work in class and at the final exam	During the semester there will be two midterm tests. The first test will be at the eighth week of classes, the second at the first week of the exam period. Student can pass the entire exam by midterm tests.

<table>
<tr><td></td><td>At the two final exams, students take parts of the curriculum that did not pass by midterm tests. If at the first final exam student passes one of the two parts of curriculum that part of curriculum the student does not have to take on another final exam.

Students who did not pass the exam after two final exams can pass the exam at the last week of August or the first week of September. Last chance to take the exam in this school year is a so-called commission exam. So-called commission exam consist of two separated tests. First test dealing with electrical engineering consist 10 theoretical questions and 2 numerical problems while second one dealing with electronics consists of 6 theoretical questions and 2 numerical problems.

The condition for positive assessment is that the student has at least 50% of each part of the curriculum at the midterm tests or at the final exams. The final grade (in percent) is formed on the basis of all activities according to the formula:

Rating (%) = 0.1 * LV + 0.45 * (G1 + G2)

wherein the activity is expressed in percentage according to:

LV - percentage obtained by laboratory exercises,
G1, G2 - percentage obtained by midterm tests or final exams of the parts of curriculum given in lectures.

The final grade is determined as follows:

Rating Grade
50% to 61% sufficient (2)
62% to 74% good (3)
75% to 87% very good (4)
88% 100% excellent (5)</td></tr>
<tr><td>Required literature (available in the library and via other media)</td><td>
<table>
<tr><th>Title</th><th>Number of copies in the library</th><th>Availability via other media</th></tr>
<tr><td>I. Jurić-Grgić: Lectures, FESB</td><td></td><td>e-learning portal</td></tr>
<tr><td>I. Marinović: Lectures, FESB</td><td></td><td>e-learning portal</td></tr>
</table>
</td></tr>
<tr><td>Optional literature (at the time of submission of study programme proposal)</td><td>A. Maletić: Osnove elektrotehnike, ELMAP, Split, 1993.
R. Wolf: Osnove električnih strojeva, Školska knjiga, Zagreb, 1985.
J. Grilec, D. Zorc: Osnove elektronike, Školska knjiga, Zagreb, 2002.</td></tr>
<tr><td>Quality assurance methods that ensure the acquisition of exit competences</td><td>- Evaluation of students presence on lectures
- Evaluation of results in accordance with the above learning outcomes
- Feedback from students via surveys
- Self-evaluation of teachers
- Institutional and non-institutional evaluations</td></tr>
<tr><td>Other (as the proposer wishes to add)</td><td></td></tr>
</table>

NAME OF THE COURSE	SHIPBUILDING TECHNOLOGY						
Code	FESD12	Year of study	3				
Course teacher	Boris Ljubenkov, Ph. D., Associate Professor	Credits (ECTS)	7				
Associate teachers		Type of instruction (number of hours)	P	S	AE	LE	CE
			45	0	15	30	0
Status of the course	Mandatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Objective of the course is to introduce students with the principles of steel ship building. Students will introduce shipbuilding production process from the beginning (steel stockyard) to the ship launching. Also, students will introduce necessary documentation for the ship building.		
Course enrolment requirements and entry competences required for the course	Ship construction		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	– Explain material flows in the shipbuilding production process. – Describe organization and material transport in the main steel stockyard. – Describe activities for steel preparing, cutting and forming. – Describe function and characteristics of production lines for micro panel and stiffened panel sub-assembly. – Explain activities of sections and blocks sub-assembly. – Describe methods for material corrosion protection in shipbuilding. – Describe activities of hull erection on the building berth. – Describe ship launching technology. – Appreciate section drawings and create technological documentation according the drawings.		
Course content broken down in detail by weekly class schedule (syllabus)	Content - lectures	L hours	
	Development of shipbuilding technology and shipyard organization. Shipbuilding market. World fleet.	3	
	Shipyard development. Domestic and significant world shipyard overview.	3	
	Shipbuilding technological process. Material flows in the shipyard. Types and characteristics of workshops in shipbuilding.	3	
	Materials for ship building. Material storage and transport.	3	
	Material flattening. Material preparing activities.	3	
	Material mechanical, oxy and plasma cutting in shipbuilding.	3	
	Characteristics of machines and production lines for plates and bars cutting in shipbuilding.	3	
	Plates and bars forming in shipbuilding.	3	
	Micro panels, stiffened panel and curved sections sub-assembly.	3	
	Sections and blocks sub-assembly.	3	
	Sections and blocks corrosion protection.	3	
	Ship hull erection methods.	3	
	Energetics and berth staging in shipbuilding.	3	

	Ship launching theory. Launching methods.	3	
	Activities of longitudinal launching.	3	
	Content - exercises		AE hours
	Basis of the shipbuilding technology		2
	Types of documentation in shipbuilding		2
	Technical documentation. Examples		2
	Technological documentation. Examples		3
	Sub-assembly fabrication. Working operations. Production lines		2
	Production lines for stiffened panel		2
	Production lines for curved sections		2
	Content - exercises		LE hours
	Drawing of the 3D model of the ship hull section		9
	Definition of material specification of the ship hull section		6
	Definition of technological documentation for sub-assembly fabrication		4
	Definition of technological documentation for stiffened panel fabrication		4
	Definition of technological documentation for ship section fabrication.		4
	Documentation corrections and report delivery		3

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, task, tests and oral exam.	

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	
	Essay		Seminar essay		Lab exercises	
	Tests	2	Oral exam	1	(Other)	
	Written exam		Project	2	(Other)	

Grading and evaluating student work in class and at the final exam	Continuous assessment during class. Two tests during the semester. Course task must be finished before oral exam. Examination: oral exam		
Required literature (available in the	**Title**	**Number of copies in the library**	**Availability via other media**

library and via other media)	Sladoljev, Ž: Tehnologija gradnje plovnih objekata - skripta, FSB zagreb, 1987.	1	
	Grubišić, M: Tehnologija gradnje broda, Zagreb, 1986.	1	
	Storch R.L. i autori: Ship Production, SNAME, 2007.	1	
Optional literature (at the time of submission of study programme proposal)	– Zbornici radova simpozija Teorija i praksa brodogradnje – SORTA – Grupa autora: Shiffbautechnologie, Berlin, 1989.		
Quality assurance methods that ensure the acquisition of exit competences	Student survey in order to evaluate teachers. Occasionally, observation and evaluation of teaching by the Head of Naval Architecture Department.		
Other (as the proposer wishes to add)			

NAME OF THE COURSE	SHIPYARD ORGANIZATION AND MANAGEMENT						
Code	FETD06	Year of study	3				
Course teacher	Boris Ljubenkov, Ph. D., Associate Professor	Credits (ECTS)	5				
Associate teachers		Type of instruction (number of hours)	P	S	AE	LE	CE
			30	0	30	0	0
Status of the course	Mandatory	Percentage of application of e-learning	0				

COURSE DESCRIPTION			
Course objectives	Objective of the course is to introduce students with significance of organization in complex production systems like shipbuilding process. Students will introduce organization principles and structures, shipyard business models, business financial measures and tasks of the shipbuilding preparing process.		
Course enrolment requirements and entry competences required for the course	Not exist		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	– Explain organization principles and structures. – Explain shipyard business models. – Describe material management methods in shipbuilding. – Explain types of costs in shipbuilding process. – Apply principles of production engineering in shipbuilding – Explain characteristics of technical and technological drawing in shipbuilding – Explain phases of planning in shipbuilding production process – Create an project plan using Critical Path Method		
Course content broken down in detail by weekly class schedule (syllabus)	Content - lectures	L hours	
	Introduction to organization. Organization development.	2	
	Organization principles. Basic models of the organization structures.	2	
	Shipbuilding process characteristics and organization.	2	
	Business – definition and characteristics. Financial result. Success index. Shipyard business collaboration.	2	
	Business policy types. Business functions. Characteristics of the shipbuilding market.	2	
	Characteristics of the shipyard business models.	2	
	Types and characteristics of ownerships. Product division and encryption.	2	
	Material management in shipbuilding.	2	
	Business resources – types and characteristics. Costs. Types of costs in shipbuilding process.	2	
	Tasks of shipbuilding preparing process. Influence of the technology on shipbuilding preparing process.	2	
	Production engineering in a modern shipyard.	2	
	Technical documentation – documents for negotiation	2	
	Technical documentation – design, workshop and delivery documents	2	
	Technological documentation – design and workshop documents.	2	

	Shipbuilding production planning – tasks and characteristics of long term, basic and operational planning	2	
	Content - exercises		AE hours
	Planning in the shipbuilding preparing and production process		2
	Basics of the Network Planning Technique		4
	Theoretical basis of the Critical Path Method		6
	Critical Path Method - example		6
	Critical Path Method – task for students		8
	Tasks corrections and delivery		4

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, task, tests and oral exam.	

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		Practical training	
	Experimental work		Report		Individual work	
	Essay		Seminar essay		Lab exercises	
	Tests	2	Oral exam	1	(Other)	
	Written exam		Project	1	(Other)	

Grading and evaluating student work in class and at the final exam	Continuous assessment during class. Two tests during the semester. Course task must be finished before oral exam. Examination: oral exam

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Sladoljev, Ž.: Organizacija i poslovanje brodogradilišta – skripta, FSB Zagreb, 2000.	1	
	Bruce G. J.: The business of shipbuilding, LPP limited, London, 2001.	1	
	Ljubenkov, B.: Organizacija i poslovanje brodogradilišta- sadržaj i raspored predavanja, FESB, 2013.		e-learning

Optional literature (at the time of submission of study programme proposal)	– Vidović, I.: Upravljanje troškovima, Brodogradnja 49, (2001)2, str.191-203. – Proceedings of the Symposium SORTA
Quality assurance methods that ensure the	Student survey in order to evaluate teachers. Occasionally, observation and evaluation of teaching by the Head of Naval Architecture Department.

acquisition of exit competences	
Other (as the proposer wishes to add)	

NAME OF THE COURSE	**Preliminary Ship Design**							
Code	FESD24	Year of study	3					
Course teacher	Branko Blagojević	Credits (ECTS)	5					
Associate teachers	Josip Bašić	Type of instruction (number of hours)	L	S	AE	LE	DE	
			15	0	0	15	30	
Status of the course	Elective	Percentage of application of e-learning	0					

COURSE DESCRIPTION			
Course objectives	Training students for the application of computers in preliminay phase of ship design.		
Course enrolment requirements and entry competences required for the course	Ship geometry. English language 1 and 2.		
Learning outcomes expected at the level of the course (4 to 10 learning outcomes)	Students will be able to: – Differentiate and describe the phases of ship design. – Explain advantages and disadvantages of application of computer programs for use in preliminay phase of ship design on examples. – Apply specialized naval architecture software in different steps of the preliminary ship design. – Independently make professional 3D models on computer and print examples on 3D printer.		
Course content broken down in detail by weekly class schedule (syllabus)	Course content	L or S hours	AE hours
	Phases of ship design.	1	
	Overview of specialized naval architecture software packages.	1	
	Preliminary design of hull geometry.	1	4
	Procedures for fairing hull geometry and prepration of models for importing in calculation modules.	1	10
	Comparison of different software for hull fairing.	1	
	Importing hull geometry into stability calculation modul. Compatibility and graphical conversion issues.	1	2
	Definition of preliminary arrangement plan: decks, bulkheads, tanks.	1	6
	Preparation of models for import into hydrodynamics calculation modules. Preliminary calculation of ship resistance.	1	4
	Importing hull geometry into CFD programs.	1	4

	Preliminary structural arrangement. Comparison of various structural design software.	1	
	Shell expansion drawings.	1	
	Importing models and preparation for 3D printing.	1	
	List of laboratory or design exercises		LE or DE hours
	3D printing.		15

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

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 assignments (Other)	2
	Essay		Seminar essay		Lab	1
	Tests		Oral exam		(Other)	
	Written exam		Project		(Other)	

Grading and evaluating student work in class and at the final exam	Continuous assessment on lectures and exercises. Final exam: defending indvidual assignment tasks on a computer. Grade: the quality of individual assignment solutions, activity and knowledge during lectures and exercises.

Required literature (available in the library and via other media)	**Title**	**Number of copies in the library**	**Availability via other media**
	Blagojević B. Computer graphics in Naval Architecture. FESB, Split 2016.		e-learning
	Bašić J. Manual for hull geometry design. FESB, 2017.		e-learning

Optional literature (at the time of submission of study programme proposal)	– Software manuals and tutorials.
Quality assurance methods that ensure the acquisition of exit competences	Attendance records. Annual analysis of exams. Student surveys. Self-evaluation of teachers. Feedback from students who have already graduated about course topics relevance in a real world.
Other (as the proposer wishes to add)	Available in English language.