Faculty of Maritime Studies / MARINE ENGINEERING / MACHINE ELEMENTS

Course:	MACHINE ELEMENTS			
Course ID	**Course status**	**Semester**	**ECTS credits**	**Lessons** (Lessons+Exercises+Laboratory)
385	Mandatory	2	3	2+1+0
Programs	MARINE ENGINEERING			
Prerequisites	No prerequisites for course enrolment and attending			
Aims	On the completion of this course, students would be able to design and to maintain machine elements and assemblages, considering STCW10 (A-III/1 and A-III/2,) and IMO model course 7.04.			
Learning outcomes	Expected learning outcomes: Upon successful completion of this subject the student will be able to: • Describe use of different types of design criteria for machine elements. • Describe various mechanical engineering materials properties. • Describe different machine elements and their function. • Apply appropriate analytical models to describe and predict the behaviour of a variety of machine elements. • Perform reduction of the behaviour of a complex machine into appropriate sub-systems and then analyze the behaviour of their elements. • Perform selection of the appropriate machine elements for different applications. • Perform basic design of a variety of machine elements. • Apply standards to machine elements design			
Lecturer / Teaching assistant	Prof.dr Janko Jovanović and Mr Draško Kovač			
Methodology	Lectures, calculation exercises, homework, consultations, test			
Plan and program of work				
Preparing week	Preparation and registration of the semester			
I week lectures	Introduction. Basic terms and classifications of machine elements.			
I week exercises	Introduction. Basic terms and classifications of machine elements.			
II week lectures	Strength based design. Manufacturability based design. Recycling based design.Working loading of machine elements (Loading types. Strain and stress. Stress concentracion). Static loading. Cyclic loading. Strenght and allowable stress of machine elements (Yield and ultimate stress. Endurance limit).			
II week exercises	Strength based design. Manufacturability based design. Recycling based design.Working loading of machine elements (Loading types. Strain and stress. Stress concentracion). Static loading. Cyclic loading. Strenght and allowable stress of machine elements (Yield and ultimate stress. Endurance limit).			
III week lectures	Preferred sizes and tolerances (Standardization. Tolerances of linear dimensions. ISO hole and shaft basis fits. Temperature influence on fits. Tolerances of form, profile, orientation, location and runout.)			
III week exercises	Preferred sizes and tolerances (Standardization. Tolerances of linear dimensions. ISO hole and shaft basis fits. Temperature influence on fits. Tolerances of form, profile, orientation, location and runout.)			
IV week lectures	Joints, connections and fasteners. Welded joints (Geometry, materials and quality). Calculation of welded joints.			
IV week exercises	Joints, connections and fasteners. Welded joints (Geometry, materials and quality). Calculation of welded joints.			
V week lectures	Welded pressure vessels. Soldering joints. Adhesive joints. Cylindrical clamp connections. Conical clamp connections. Clamping heads.			
V week exercises	Welded pressure vessels. Soldering joints. Adhesive joints. Cylindrical clamp connections. Conical clamp connections. Clamping heads.			
VI week lectures	Threaded fasteners (Thread profile parameters. Standard thread profiles. Bolts. Nuts. Washers. Materials. Manufacturing and surface protection. Prevention of threaded fasteners loosening)			
VI week exercises	Threaded fasteners (Thread profile parameters. Standard thread profiles. Bolts. Nuts. Washers. Materials. Manufacturing and surface protection. Prevention of threaded fasteners loosening)			
VII week lectures	Calculation of threaded fasteners (Axially loaded bolted joints. Transversaly laoded bolted joints. Multi-bolted joints). Joints of shafts and power-transmitting elements (Key joint. Splined shaft joints). Springs (Flexion spings. Torsion spings)			
VII week exercises	The First Compulsory Test			
VIII week lectures	Springs (Compression and extension springs. Rubber elastic elements) Motion-transmitting elements. Shafts and axles (Materials. Calculation)			

VIII week exercises	Springs (Compression and extension springs. Rubber elastic elements) Motion-transmitting elements. Shafts and axles (Materials. Calculation)
IX week lectures	Sleeves (Axial sleeves. Cross sleeves) Slider bearings (Friction and lubrication. Types and materials. Calculation)
IX week exercises	Sleeves (Axial sleeves. Cross sleeves) Slider bearings (Friction and lubrication. Types and materials. Calculation)
X week lectures	Rolling element bearings (Types and marking system. Assemblage and lubrication. Calculation) Power-transmitting elements. Gearing transmission (Types).
X week exercises	Rolling element bearings (Types and marking system. Assemblage and lubrication. Calculation) Power-transmitting elements. Gearing transmission (Types).
XI week lectures	Gearing transmission (Basic parameters. Involute gears. Materials and manufacturing. Spur gears – Undercuting and Loading)
XI week exercises	Gearing transmission (Basic parameters. Involute gears. Materials and manufacturing. Spur gears – Undercuting and Loading)
XII week lectures	Gearing transmission (Helical gears. Bevel gears. Worm gears. Bending at the fillet of the gear tooth – working and allowable stress. Contact pressure on the flank of the gear tooth – working and allowable stress)
XII week exercises	Gearing transmission (Helical gears. Bevel gears. Worm gears. Bending at the fillet of the gear tooth – working and allowable stress. Contact pressure on the flank of the gear tooth – working and allowable stress)
XIII week lectures	Gearing transmission in the ship’s propulsion system. Belt transmission. Chain transmission.
XIII week exercises	Gearing transmission in the ship’s propulsion system. Belt transmission. Chain transmission.
XIV week lectures	Couplings (Rigid couplings. Flexible couplings. On-off couplings. Hydrodynamics couplings. Special couplings)
XIV week exercises	The Second Compulsory Test
XV week lectures	Flow elements. Pipes (Materials. Connection. Calculation). Pipe fasteners (Valves. Latches. Covers)
XV week exercises	The Additional First and Second Compulsory Tests
Student workload	Peer week 3 credits x 40/30 = 4 hours Structure: Lectures: 2 hours of lectures Exercises: 1 hour of exercises Individual work including consultation: 1 hour Per semester Classes and final exam: 4 hours x 16 weeks = 64 hours Necessary preparations before the semester start (administration, enrolment, verification): 4 hours x 2 weeks = 8 hours Total load for the subject: 3 x 30 = 90 hours Remedial classes for the corrective term, including the corrective exam: 90 hours – (64 hours + 8 hours) = 18 hours Load structure: 64 hours (Classes) + 8 hours (Preparation) + 18 hours (Remedial classes)

Per week	**Per semester**
3 credits x 40/30=4 hours and 0 minuts 2 sat(a) theoretical classes 0 sat(a) practical classes 1 excercises **1 hour(s) i 0 minuts** of independent work, including consultations	Classes and final exam: **4 hour(s) i 0 minuts x 16 =64 hour(s) i 0 minuts** Necessary preparation before the beginning of the semester (administration, registration, certification): **4 hour(s) i 0 minuts x 2 =8 hour(s) i 0 minuts** Total workload for the subject: **3 x 30=90 hour(s)** Additional work for exam preparation in the preparing exam period, including taking the remedial exam from 0 to 30 hours (remaining time from the first two items to the total load for the item) **18 hour(s) i 0 minuts** Workload structure: **64 hour(s) i 0 minuts (cources), 8 hour(s) i 0 minuts (preparation), 18 hour(s) i 0 minuts (additional work)**
Student obligations	Students are obliged to attend lectures, submit homework assignments and take final exam
Consultations	2 times per week
Literature	Vojislav Miltenović, Radoš Bulatović, Machine elements - Textbook and tables, University of Montenegro, 2007 Radoš Bulatović, Janko Jovanović, Machine elements - Workbook, University of Montenegro, 2014
Examination methods	: Four homeworks 4x4 = 16 points Attendance to lectures 4 points Two tests 2x15 = 30 points Final exam 50 points Passing mark is awarded if the student collects at least 50 points
Special remarks	
Comment	

Grade:	F	E	D	C	B	A
Number of points	less than 50 points	greater than or equal to 50 points and less than 60 points	greater than or equal to 60 points and less than 70 points	greater than or equal to 70 points and less than 80 points	greater than or equal to 80 points and less than 90 points	greater than or equal to 90 points