



		GENERAL IN	FORMATION					
Studies	DEGREE IN MEC	CHANICAL ENGINEERING	Subject	RESISTANCE STRUCTURE	OF M/ S	ATERIA	ALS AND	THEORY
Semester	2	Course 2	Mention / Field of					
Character	COMPULSORY	Madality Face to face	specialisation		OTELL			
Plan Credits	4 5	Hours/week 3.61	Language Total hours	64 98 class ho	SIELL	ANO/E	on-class	hours = 1 1
0.00.00	.,.			total hours				<u></u>
		2030 AGEN	DA GOALS					
ADUSTRY, INCLUDED INDECEMBER INDE								
		PROFE	SSORS					
IRAGUI SA	N PEDRO, MIKEL							
LARRAÑAC	GA SERNA, MIRE	N						
AZPI-OTEC	GUI ARRUTI, JON	(GOIERRI)						
	0.1.1	REQUIRED PREVIO	OUS KNOWLED	GE				
	Subje	cts		Know	vledge		rod	
IATHEMATICS I			(1	NO previous kric	Jwieuge	erequi	eu)	
IATHEMATICS II	I							
HYSICS I								
IECHANICS								
IATERIALS SCIE	ENCE FOUNDATIO							_
	II TC	LEARNING	RESULTS		KC	SK	AR	ECTS
EARNING RESU MR206 - To know -RTR1 - To deve ecoming aware of npact of the prop	JLTS v and use the prind lop interdisciplinar of respect for huma losed solutions on constrating the abili	ciples of material resistance y projects specific to their specialty an rights and fundamental rights, a the SDGs - to acquire and/or appl	A and of gradual com ind analyzing and as: y basic, advanced ar o and/or undertake fi	plexity, - sessing the id/or	КС	SK x x	АВ	ECTS 4,02 0,32
EARNING RESU SMR206 - To know S-RTR1 - To deve ecoming aware of npact of the propi- vant-garde, demi- vith a high degree S-RTR2 - To expre- oherent manner, ources, using inc	JLTS v and use the prind lop interdisciplinar of respect for huma oosed solutions on onstrating the abili e of autonomy ess information, idd orally and in writir clusive and non-dis	ciples of material resistance y projects specific to their specialty an rights and fundamental rights, a the SDGs - to acquire and/or appl ty to work in multidisciplinary team eas and the arguments that suppo ig, based on quality information, so criminatory language	A and of gradual com ind analyzing and ass y basic, advanced ar is and/or undertake fir rt them in an orderly, elf-made or obtained	plexity, - sessing the nd/or urther studies clear and from different	КС	SK x x x	AB	ECTS 4,02 0,32 0,16
EARNING RESU SMR206 - To know G-RTR1 - To deve ecoming aware of npact of the prop vant-garde, dem- vith a high degree G-RTR2 - To expre- oherent manner, ources, using inc	JLTS v and use the prind lop interdisciplinar of respect for huma oosed solutions on onstrating the abili e of autonomy ess information, ide orally and in writir clusive and non-dis	ciples of material resistance y projects specific to their specialty an rights and fundamental rights, a the SDGs - to acquire and/or appl ty to work in multidisciplinary team eas and the arguments that suppo ag, based on quality information, se acriminatory language	A and of gradual com ind analyzing and ass y basic, advanced ar is and/or undertake fir rt them in an orderly, elf-made or obtained	plexity, - sessing the nd/or urther studies clear and from different	КС	SK x x	AB Total:	ECTS 4,02 0,32 0,16 4,5
EARNING RESU MR206 - To know G-RTR1 - To deve ecoming aware of npact of the prop vant-garde, dem- vith a high degree G-RTR2 - To expre- oherent manner, ources, using inc C: Knowledge or Com-	JLTS v and use the prind lop interdisciplinary of respect for huma osed solutions on onstrating the abili e of autonomy ess information, ide orally and in writir clusive and non-dis netent / SK: Skills / AB: /	ciples of material resistance y projects specific to their specialty an rights and fundamental rights, a the SDGs - to acquire and/or appl ty to work in multidisciplinary team eas and the arguments that suppo ng, based on quality information, so coriminatory language	A and of gradual com ind analyzing and ass y basic, advanced ar is and/or undertake fu rt them in an orderly, elf-made or obtained	plexity, - sessing the nd/or urther studies clear and from different	КС	SK x x	AB Total:	ECTS 4,02 0,32 0,16 4,5
EARNING RESU SMR206 - To know S-RTR1 - To deve ecoming aware of npact of the propi- vant-garde, demi- vith a high degree S-RTR2 - To expre- oherent manner, ources, using inco- C: Knowledge or Cor- ENAEE LEARNII ENA102 - Knowle- necessary to acqui-	JLTS v and use the prind lop interdisciplinar of respect for huma oosed solutions on onstrating the abili e of autonomy ess information, ide orally and in writir clusive and non-dis netent / SK: Skills / AB: / NG RESULTS dge and comprehe uire the rest of the	ciples of material resistance y projects specific to their specialty an rights and fundamental rights, a the SDGs - to acquire and/or appl ty to work in multidisciplinary team eas and the arguments that suppo og, based on quality information, so ccriminatory language Abilities ension: Knowledge and compreher competencies of the degree, inclu	A and of gradual com ind analyzing and ass y basic, advanced ar is and/or undertake fir rt them in an orderly, elf-made or obtained	plexity, - sessing the nd/or urther studies clear and from different ing disciplines of atest advances.	KC	SK x x x	AB Total:	ECTS 4,02 0,32 0,16 4,5
EARNING RESU MR206 - To know G-RTR1 - To deve ecoming aware of npact of the prop- vant-garde, dem- vith a high degree G-RTR2 - To expre- oherent manner, ources, using inco- C: Knowledge or Cor ENAEE LEARNII ENA102 - Knowle- necessary to acque ENA103 - Knowle-	JLTS v and use the prind lop interdisciplinary of respect for huma oosed solutions on onstrating the abili e of autonomy ess information, ide orally and in writir clusive and non-dis netent / SK: Skills / AB: / NG RESULTS dge and comprehe uire the rest of the dge and comprehe	ciples of material resistance y projects specific to their specialty an rights and fundamental rights, a the SDGs - to acquire and/or appl ty to work in multidisciplinary team eas and the arguments that suppo ng, based on quality information, se criminatory language Abilities ension: Knowledge and compreher competencies of the degree, inclu- ension: Awareness of the multidisc	A and of gradual com ind analyzing and ass y basic, advanced ar is and/or undertake fir rt them in an orderly, elf-made or obtained	plexity, - sessing the nd/or urther studies clear and from different ing disciplines o atest advances. gineering.	KC	SK x x x	AB Total:	ECTS 4,02 0,32 0,16 4,5
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EARNING RESU MR206 - To know ARTR1 - To deve ecoming aware of npact of the prop- vant-garde, dem- rith a high degree ARTR2 - To expre- oherent manner, ources, using inco- C: Knowledge or Co- ENAEE LEARNIE ENA102 - Knowle- enecessary to acque ENA105 - Analysis adequately estab- environmental, ec- ENA106 - Enginee- processes and sy environmental, ec- environmental,	JLTS v and use the princ lop interdisciplinary of respect for huma oosed solutions on onstrating the abili e of autonomy ess information, ide orally and in writin clusive and non-dis meent / SK: Skills / AB: / NG RESULTS dge and comprehe uire the rest of the dge and comprehe s in engineering: T lished analytical, c conomic, and indus ering projects: Abil restems of their spe conomic and indus	ciples of material resistance y projects specific to their specialty an rights and fundamental rights, a the SDGs - to acquire and/or appl ty to work in multidisciplinary team eas and the arguments that suppo ng, based on quality information, so coriminatory language Abilities ension: Knowledge and compreher competencies of the degree, inclu ension: Awareness of the multidisc the ability to identify, formulate and alculation and experimental metho strial restrictions. ity to project, design and develop of ciality, which meet the established trial aspects, as well as selecting a	A and of gradual com ind analyzing and ass y basic, advanced ar is and/or undertake fi rt them in an orderly, elf-made or obtained insion of the engineer iding notions of the la iplinary context of en a solve engineering p ods; and acknowledg complex products (pa requirements, incluce and applying appropri	plexity, - sessing the ad/or urther studies clear and from different ing disciplines of atest advances. gineering. roblems in their e the importance arts, component ling awareness jate project met	κc of their : specia ce of so of the s of the s thods	SK x x special ality; ch cial, he ned pro social,	AB Total:	ECTS 4,02 0,32 0,16 4,5 4,5 e level 4 apply safety, id safety,
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EARNING RESU MR206 - To know -RTR1 - To deve ecoming aware of pact of the prop- vant-garde, dem- ith a high degree -RTR2 - To expre- oberent manner, purces, using inc C: Knowledge or Cor ENAEE LEARNIE ENA102 - Knowled EXA103 - Knowled EXA103 - Knowled EXA105 - Analysis dequately estab environmental, eco EXA106 - Enginee rocesses and sy environmental, eco EXA109 - Researd EXA109 - Researd EXA109 - Researd EXA109 - Researd EXA109 - Researd EXA110 - Researd EXA110 - Researd EXA111 - Practica heir limitations in EXA112 - Practica EXA113 - Practica EXA115 - Practica	JLTS v and use the principlinary of respect for huma ossed solutions on onstrating the abili e of autonomy ess information, ide orally and in writin clusive and non-dise thent / SK: Skills / AB: / NG RESULTS dge and comprehe uire the rest of the dge and comprehe s in engineering: T lished analytical, c conomic, and indus ering projects: Abil rstems of their spe conomic and indus ch and innovation: ch and innovation: ch and innovation: ch and innovation: ch and innovation if field of study. al application of en the field of their s al application of en tions specific to th al application of en the in the field of their al application of en	Ciples of material resistance y projects specific to their speciality an rights and fundamental rights, a the SDGs - to acquire and/or appl ty to work in multidisciplinary team eas and the arguments that suppo ag, based on quality information, se criminatory language Abilities ension: Knowledge and compreher competencies of the degree, inclu- ension: Awareness of the multidisc he ability to identify, formulate and alculation and experimental methor strial restrictions. ity to project, design and develop of ciality, which meet the established trial aspects, as well as selecting a Ability to consult and apply codes Capacity and ability to project and gineering: Understanding of the ap peciality. gineering: Knowledge of application the field of their speciality. gineering: Knowledge of the socia	A RESULTS y and of gradual com ind analyzing and ass y basic, advanced ar is and/or undertake fur- rit them in an orderly, elf-made or obtained insion of the engineering iding notions of the lation iplinary context of en- it solve engineering p ods; and acknowledge complex products (par- requirements, incluce and applying appropri- of good practice and it carry out experiment oplicable techniques in oplicable techniques in	plexity, - sessing the ad/or urther studies clear and from different ing disciplines of atest advances. gineering. roblems in their e the importance arts, component ling awareness iate project met d security in their tal investigation and methods fr lems, carry out ment and tools, environmental, o	κc of their : of their : of the stand the stand of the stand the	SK x x x special dity; ch cial, he ned pro social, ality. rpret re social, ality. rpret re social, ality. rpret re social, ality. rpret re social, ality.	AB Total:	ECTS 4,02 0,32 0,16 4,5 e level 1 apply safety, id safety, id safety,
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engineering and with society in general.

ENA120 - Communication and Teamwork: Ability to operate effectively in domestic and international contexts, individually and as a team, and to cooperate with both engineers and people from other disciplines.

SECONDA	NRY LEA	RNING RESULTS			
2RGM293 (2 sem)					
LEARNING ACTIVITIES			СН	NCH	тн
Development and writing of records, reports, presentation projects/work experience/challenges/case studies/experin individually and/or in teams	ns, audiovis mental inve	sual material, etc. on estigations carried out	,66 h.	1,34 h.	2 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANI	SMS		
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems Comments: Continuous evaluation. FEEDBACK received tutor and the experts in the project follow-up meetings	100% d from the	Comments: Continuo tutor in the project follow	<i>(No mecha</i> us evaluatior v-up meeting	anisms) n. FEEDBACK Is	received from th
CH - Class hours: ,66 h. NCH - Non-class hours: 1,34 h. TH - Total hours: 2 h.					

RGM219 [!] Identifica y evalúa las situaciones tensionales que soportan los elementos estructurales

LEARNING ACTIVITIES			СН	NCH	тн
Conducting tests, giving presentations, presenting defend checkpoints	ces, taking	examinations and/or doir	ng 4 h.	7 h.	11 h.
Presentation by the teacher in the classroom, in participa procedures associated with the subjects	tory classe	es, of concepts and	15 h.		15 h.
Carrying out exercises and solving problems individually	and/or in t	eams	4 h.	8 h.	12 h.
Comments: Analyses and evaluates structural component	nts, to fulfi	II working and safety conc	litions		
EVALUATION SYSTEM	W	MAKE-UP MECHANI	SMS		
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory	25%	Individual written and/ coding/programming t	or oral tests ests	or individual	
exercises, term projects, challenges and problems		Comments: R1*0.75+	-N1*0.25		
Individual written and/or oral tests or individual coding/programming tests	75%				
Comments: N1 = 0.75*KP1 + 0.25*A1 < 5> R1 retake	exam				
must be done					
CH - Class hours: 23 h. NCH - Non-class hours: 15 h. TH - Total hours: 38 h.					

RGM220 [!] Calcula y dimensiona, mediante criterios de rigidez y resistencia, los elementos estructurales simples sometidos a cargas estáticas, y define su estado de deformación

LEARNING ACTIVITIES	СН	NCH	ТН
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	3 h.	5 h.	8 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.		20 h.
Carrying out exercises and solving problems individually and/or in teams Comments: Analyses and evaluates structural components, to fulfill working and safety condition	5 h. O NS.	7,5 h.	12,5 h.





EVALUATION SYSTEM	W	MAKE-UP MECHANIS	SMS		
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory	25%	Individual written and/o	or oral tests o	or individual	
exercises, term projects, challenges and problems		Comments: N2*0,25+	R2*0,75		
Individual written and/or oral tests or individual	75%	,			
coding/programming tests					
Comments: N2=0,25*A2+0,75*KP2 N2<5> R2 retake e	exam				
must be done					
CH - Class hours: 28 h					
NCH - Non-class hours: 12,5 h.					
TH - Total hours: 40,5 h.					
$2DCM^{204}$ (2 com)					
ZKGWZ94 (Z Sem)					
LEARNING ACTIVITIES			СН	NCH	тн
Development and writing of records, reports, presentation	ns. audiovis	sual material, etc. on	,66 h.	1,34 h.	2 h.
projects/work experience/challenges/case studies/experir	nental inve	stigations carried out			
individually and/or in teams					
EVALUATION SYSTEM	W	MAKE-UP MECHANIS	SMS		
Presentation and defence of exercises case studies	100%		(No mech:	anisms)	
computer practical work, simulation practical work.	10070	Comments: Continuo	is evaluation	FEEDBACK	received from the
laboratory practical work, term projects, end of degree		tutor in the project follow	/-up meeting	IS	
project, master's thesis, challenges and problems			-1 5	-	
Comments: Continuous evaluation. FEEDBACK received	d from the				
Comments: Continuous evaluation. FEEDBACK received tutor and the experts in the project follow-up meetings	d from the				
Comments: Continuous evaluation. FEEDBACK received tutor and the experts in the project follow-up meetings	d from the				
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Comments: Continuous evaluation. FEEDBACK received tutor and the experts in the project follow-up meetings CH - Class hours: ,66 h. NCH - Non-class hours: 1,34 h. TH - Total hours: 2 h. 2RGM291 (2 sem) LEARNING ACTIVITIES Carrying out/resolving projects/challenges/cases, etc. to p interdisciplinary contexts, real and/or simulated, individual	d from the	utions to problems in n teams	<u>Сн</u> 1 h.	<u>NCH</u> 2 h.	<u>ТН</u> 3 h.
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Comments: Continuous evaluation. FEEDBACK received tutor and the experts in the project follow-up meetings CH - Class hours: ,66 h. NCH - Non-class hours: 1,34 h. TH - Total hours: 2 h. 2RGM291 (2 sem) LEARNING ACTIVITIES Carrying out/resolving projects/challenges/cases, etc. to p interdisciplinary contexts, real and/or simulated, individual EVALUATION SYSTEM Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory expressions, to the projects of a problement	brovide sol lly and/or i <u>W</u> 50%	utions to problems in n teams <u>MAKE-UP MECHANIS</u> Comments: Continuou	CH 1 h. SMS (No mecha us evaluation	NCH 2 h. anisms) 1. FEEDBACK	TH 3 h. received from the
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Goi Eskola Politeknikoa | Mondragon Unibertsitatea

Course: 2024 / 2025 - Course planning



LEARNING ACTIVITIES			СН	NCH	тн
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams			,66 h.	1,34 h.	2 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANIS	SMS		
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems Self-assessment Comments: Continuous evaluation. FEEDBACK received tutor and the experts in the project follow-up meetings The of the marks of the tutor's assessment and the self-assess carried out by the work team is calculated, using the define Afterwards, the final mark is calculated by multiplying the a mark by a factor calculated on the basis of the co-evaluation	50% 50% d from the average ment ed rubrics. average on among	Comments: Continuot tutor and the experts in	(No mecha us evaluation the project fo	anisms) I. FEEDBACK Illow-up meetir	received from the
the members of the group CH - Class hours: ,66 h. NCH - Non-class hours: 1,34 h. TH - Total hours: 2 h.					

RGM221 [!] Modeliza, calcula y dimensiona elementos estructurales simples atendiendo a las especificaciones definidas en su diseño

LEARNING ACTIVITIES	СН	NCH	тн
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	2 h.	4 h.	6 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	,5 h.	1 h.	1,5 h.
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	7,5 h.	7 h.	14,5 h.

Comments: Analyses and evaluates structural components to fulfill working and safety conditions, considering manufacturing and economic criteria. Calculation is carried out by the updated version of SolidWorks Simulation.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%	Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems Comments: The mark of this learning outcome is the technic mark of the semester project. It is based on the report delivere achieved results, the abilities shown and the defence	50% cal ed, the	and problems Comments: The assessment of the project is continuous, and based on the tracking meetings carried out with the tutor and experts. One week before the final report delivery, a final tracking meeting is done where the work done is presented and the aspects that should be improved are identified.

CH - Class hours: 10 h. NCH - Non-class hours: 12 h. TH - Total hours: 22 h.

2RGM290 (2 sem)						
LEARNING ACTIVITIES			СН	NCH	тн	
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams				2 h.	3 h.	
EVALUATION SYSTEM	W	MAKE-UP MECHANI	SMS			
Reports on the completion of exercises, case studies,	100%		(No mech	anisms)		





computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems **Comments:** Continuous evaluation. FEEDBACK received from the tutor and the experts in the project follow-up meetings **Comments:** Continuous evaluation. FEEDBACK received from the tutor and the experts in the project follow-up meetings

CH - Class hours: 1 h. NCH - Non-class hours: 2 h. TH - Total hours: 3 h.

CONTENTS

- 0. Introduction
- 1. Internal forces, stress resultants and diagrams
- 2. Stress and strain
- 3. Axial force. Tension-Compression
- 4. Torsion
- 5. Bending

LEARNING RESOURCES AND BIBLIOGRAPHY				
Learning resources	Bibliography			
Moodle Platform [!]	Mechanics of Materials, Roy R. Craig Jr., 3rdedition, 2011, ISBN 978-0-470-48181-3, John Wiley and Sons			
	Introduction to Linear Elasticity, Phillip L. Gould, 3rd ed., 2013, ISBN: 978-1-4614-4833-4 (Online), Springer			
	Strength and Stiffness of Engineering Systems, Frederick A. Leckie, Dominic J. Dal Bello, 2009, ISBN: 978-0-387-49474-6 (Online), Springer			
	Mechanics of Materials, R. C. Hibbeler., 9th edition, 2014, ISBN 978-0-13-325442-6, Pearson			
	Mechanics of Materials, F. P. Beer., 6th edition, 2012 , ISBN 978-0-07-338028-5, McGrawHill			
	Mechanics and Strength of Materials, Vitor Dias da Silva, 2006, ISBN: 978-3-540-30813-3 (Online), Springer			