



	[GMH302] ENGINEE	RING MATE	RIALS			
	GENERAL IN	FORMATION				
Studies DEGREE IN MEC	HANICAL ENGINEERING	Subject	?			
Semester 2	Course 3	Mention / Field of				
Character COMPULSORY		specialisation				
Plan 2022	Modality Face-to-face	Language	EUSKARA/CAST	ELLANC	/ENGLISI	H
Credits 6	Hours/week 3.61	Total hours	65 class hours + hours	85 non-c	lass hours	s = <u>150 total</u>
	2030 AGEN	DA GOALS				
8 Extension of the second seco						
	PROFES	SSORS				
TATO VEGA, GUILSON						
IBARRETXE LOPEZ, UNAI						
MUNIZ GARCIA, LAURA			_			
• · · ·		OUS KNOWLED	GE			
		knowledge en en s	Knowle	dge	doffacta !	ordonine
CHEMISTRY		mechanisms	anne structure, ci	ystalline	uenects, r	aruening
		Oxidation-reduction	reactions basics			
		Microstructure-mec	hanical properties	relation		
	LEARNING	RESULTS				
LEARNING RESULTS				KC SK	AB	ECTS
G-RTR1 - To develop interdisciplinary becoming aware of respect for huma impact of the proposed solutions on avant-garde, demonstrating the abili with a high degree of autonomy	y projects specific to their specialty an rights and fundamental rights, and the SDGs - to acquire and/or apply ty to work in multidisciplinary teams	and of gradual com nd analyzing and ass / basic, advanced ar s and/or undertake fu	blexity, - sessing the d/or urther studies	x		0,44
coherent manner, orally and in writin sources, using inclusive and non-dis KC: Knowledge or Content / SK: Skills / AB: A	g, based on quality information, se criminatory language	If-made or obtained	from different		Total:	6
ENAEE LEARNING RESULTS						
ENA102 - Knowledge and comprehene necessary to acquire the rest of the ENA103 - Knowledge and comprehe ENA104 - Analysis in engineering: T relevant analytical, calculation and e ENA105 - Analysis in engineering: T adequately established analytical, c environmental, economic, and indust	ension: Knowledge and comprehen competencies of the degree, inclu- ension: Awareness of the multidisci he ability to analyse complex prode experimental methods in a suitable he ability to identify, formulate and alculation and experimental metho strial restrictions.	sion of the engineeri ding notions of the la plinary context of en ucts, processes and way; and correctly in solve engineering p ds; and acknowledge	ng disciplines of t test advances. gineering. systems in their fi terpret the result roblems in their sp e the importance of	eld of stu of such peciality; of social,	iality, at th dy; choose analyses. choose an health and	e level e and apply d apply d safety,
ENA106 - Engineering projects: Abili processes and systems of their spe environmental, economic and indus	ty to project, design and develop of ciality, which meet the established trial aspects, as well as selecting a	omplex products (pa requirements, includ applying appropr	rts, components, ing awareness of iate project metho	finished p the socia ds.	oroducts, e I, health a	etc.), ind safety,
ENA107 - Engineering projects: Proj ENA108 - Research and innovation: with discretion, in order to carry out	ect capacity some state-of-the-art Ability to carry out bibliographic se simulation and analysis with the ai	knowledge of their en arches and consult a m of conducting rese	ngineering special and use database earch on technical	ity. s and oth topics of	er informa their spec	ation sources ciality.
ENA109 - Research and innovation: Ability to consult and apply codes of good practice and security in their speciality. ENA110 - Research and innovation: Capacity and ability to project and carry out experimental investigations, interpret results, and reach						
ENA111 - Practical application of en	gineering: Understanding of the ap	plicable techniques	and methods fr an	alysis, de	sign and	research and
ENA112 - Practical application of en conduct investigations specific to th	gineering: Practical competency to eir speciality.	solve complex prob	ems, carry out co	mplex en	gineering	projects, and
ENA113 - Practical application of en processes, and their limitations in the	gineering: Knowledge of applicatio e field of their speciality.	n of materials, equip	ment and tools, er	ngineerin	g technolo	ogy and
ENA115 - Practical application of en implications of engineering practice.	gineering: Knowledge of the social	, health and safety, e	environmental, eco	onomic ai	nd industri	al
ENA118 - Preparation of judgements responsibility for decision making.	S: ADILITY to manage complex techn	ical or protessional a	ictivities or project	s of their	speciality	, taking





ENA119 - Communication and Teamwork: Ability to effectively communicate information, ideas, problems and solutions in the field of 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.

ENA122 - Continued training: Ability to stay up to date on science and technology innovations.

2RGM392 (2 sem)

LEARNING ACTIVITIES		СН	NCH	ТН
Carrying out/resolving projects/challenges/cases, etc. to pinterdisciplinary contexts, real and/or simulated, individual	provide so ally and/or	utions to problems in in teams	3 h.	3 h.
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	100%	Reports on the completion of exercises, case studies, complexercises, simulation exercises, laboratory exercises, term projects, challenges and problems		
Comments: Students have the responsability of meeting to do the tracking of the project and to ensure the achiever the goals.	the tutor nent of	Comments: Continuous evaluat tutor in the semester project follow	on. FEEDBACK /-up meetings.	(received from th
CH - Class hours: 0 h. NCH - Non-class hours: 3 h. TH - Total hours: 3 h				

RGM331 [!] Relaciona las características de los materiales compuestos con sus propiedades y ámbitos de aplicación, según la composición y el proceso de fabricación

LEARNING ACTIVITIES			СН	NCH	ТН
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning				4 h.	9 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints			1 h.		1 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects				2 h.	14 h.
Carrying out exercises and solving problems individually and/or in teams			1 h.	4 h.	5 h.
Practical work in workshops and/or laboratories, individually and/or in teams			1 h.		1 h.
Reading and personal and/or shared analysis of relev articles, catalogues, etc.) related to the speciality	ant and currer	nt publications (books,		4 h.	4 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISM	IS		
Individual written and/or oral tests or individual coding/programming tests	100%	Individual written and/or coding/programming tes	oral tests ts	or individual	

CH - Class hours: 20 h. NCH - Non-class hours: 14 h. TH - Total hours: 34 h.

RGM333 [!] Selecciona materiales para el diseño de componentes y productos teniendo en cuenta las especificaciones y el procesado, y utilizando la metodología adecuada

LEARNING ACTIVITIES	СН	NCH	ТН
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning	2 h.	4 h.	6 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	3 h.	3 h.	6 h.



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					Superior
Computer simulation exercises individually and/or in teams	\$		4 h.	5 h.	9 h.
Presentation by the teacher in the classroom, in participator	ory classe	s, of concepts and	10 h.		10 h.
Carrying out exercises and solving problems individually an	nd/or in te	eams	1 h.	1 h.	2 h.
EVALUATION SYSTEM	w	MAKE-UP MECHAN	IISMS		
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems CH - Class hours: 20 h. NCH - Non-class hours: 13 h.	100%	Individual written and coding/programming	d/or oral tests of tests	or individual	
2RGM391 (2 sem)					
LEARNING ACTIVITIES			СН	NCH	тн
Carrying out/resolving projects/challenges/cases, etc. to pro	ovide sol	utions to problems in		4 h.	4 h.
interdisciplinary contexts, real and/or simulated, individually	y and/or i	n teams			
EVALUATION SYSTEM	W	MAKE-UP MECHAN	IISMS		
Comments: The average of the marks of the tutor's assess and the self-assessment carried out by the work team is calcul- using the defined rubrics. Afterwards, the final mark is calcul-	sment culated, ated by	Comments: Continut tutor in the semester r	and problems ous evaluation	n. FEEDBACK	received from th
multiplying that average mark by a factor calculated on the b the co-evaluation among the members of the group. CH - Class hours: 0 h. NCH - Non-class hours: 4 h. IFH - Total hours: 4 h. 2RGM393 (2 sem)	asis of			p meetings.	
multiplying that average mark by a factor calculated on the b the co-evaluation among the members of the group. CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h. 2RGM393 (2 sem)	asis of			NCH	714
multiplying that average mark by a factor calculated on the b the co-evaluation among the members of the group. CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h. ZRGM393 (2 sem) LEARNING ACTIVITIES Development and writing of records, reports, presentations, projects/work experience/challenges/case studies/experime individually and/or in teams EVALUATION SYSTEM	, audiovis ental inve	sual material, etc. on estigations carried out	CH	<i>NCH</i> 6 h.	<u>ТН</u> 6 h.
multiplying that average mark by a factor calculated on the b the co-evaluation among the members of the group. CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h. PRGM393 (2 sem) LEARNING ACTIVITIES Development and writing of records, reports, presentations, projects/work experience/challenges/case studies/experime individually and/or in teams EVALUATION SYSTEM Reports on the completion of everciess, case studies	, audiovis ental inve <u>W</u> 100%	sual material, etc. on estigations carried out MAKE-UP MECHAN Reports on the corre	CH IISMS	NCH 6 h.	TH 6 h.
multiplying that average mark by a factor calculated on the b the co-evaluation among the members of the group. CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h. ZRGM393 (2 sem) LEARNING ACTIVITIES Development and writing of records, reports, presentations, projects/work experience/challenges/case studies/experime individually and/or in teams EVALUATION SYSTEM Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems Comments: Students have the responsability of meeting th o do the tracking of the project and to ensure the achieveme he goals.	, audiovis ental inve <u>w</u> 100% ne tutor ent of	sual material, etc. on estigations carried out MAKE-UP MECHAN Reports on the comp exercises, simulatior projects, challenges Comments: Continu tutor in the semester p	CH IISMS Detion of exercises, lat and problems ous evaluatior project follow-u	NCH 6 h. cises, case stu poratory exerc h. FEEDBACK p meetings.	TH 6 h. dies, computer ises, term received from th
multiplying that average mark by a factor calculated on the b the co-evaluation among the members of the group. CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h. ZRGM393 (2 sem) LEARNING ACTIVITIES Development and writing of records, reports, presentations, projects/work experience/challenges/case studies/experime individually and/or in teams EVALUATION SYSTEM Reports on the completion of exercises, laboratory exercises, term projects, challenges and problems Comments: Students have the responsability of meeting th o do the tracking of the project and to ensure the achieveme he goals. CH - Class hours: 0 h. YCH - Non-class hours: 6 h.	, audiovis ental inve <u>w</u> 100% he tutor ent of	sual material, etc. on estigations carried out MAKE-UP MECHAN Reports on the comp exercises, simulatior projects, challenges Comments: Continu tutor in the semester p	CH IISMS Detion of exercises, lat and problems ous evaluation project follow-u	NCH 6 h. cises, case stu poratory exerc h. FEEDBACK p meetings.	TH 6 h. dies, computer ises, term received from th
multiplying that average mark by a factor calculated on the b the co-evaluation among the members of the group. CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h. ZRGM393 (2 sem) LEARNING ACTIVITIES Development and writing of records, reports, presentations, projects/work experience/challenges/case studies/experime individually and/or in teams EVALUATION SYSTEM Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems Comments: Students have the responsability of meeting the odo the tracking of the project and to ensure the achieveme the goals. CH - Class hours: 0 h. YCH - Non-class hours: 6 h. TH - Total hours: 6 h.	, audiovis asis of w 100% he tutor ent of	sual material, etc. on estigations carried out MAKE-UP MECHAN Reports on the comp exercises, simulatior projects, challenges Comments: Continu tutor in the semester p	CH IISMS Deletion of exercises, lal and problems ous evaluatior project follow-u	NCH 6 h. bises, case stu boratory exerc h. FEEDBACK p meetings.	TH 6 h. dies, computer ises, term received from th
multiplying that average mark by a factor calculated on the b the co-evaluation among the members of the group. CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h. ZRGM393 (2 sem) LEARNING ACTIVITIES Development and writing of records, reports, presentations, projects/work experience/challenges/case studies/experime individually and/or in teams EVALUATION SYSTEM Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems Comments: Students have the responsability of meeting th o do the tracking of the project and to ensure the achieveme the goals. CH - Class hours: 0 h. CH - Non-class hours: 6 h. TH - Total hours: 6 h.	, audiovis ental inve <u>W</u> 100% ne tutor ent of	sual material, etc. on estigations carried out MAKE-UP MECHAN Reports on the comp exercises, simulatior projects, challenges Comments: Continu tutor in the semester p	CH IISMS Deletion of exercises, lal and problems ous evaluation project follow-u	NCH 6 h. cises, case stu poratory exerc h. FEEDBACK p meetings.	TH 6 h. dies, computer ises, term received from th





Escuela Politécnica 2 h. 4 h. Development and writing of records, reports, presentations, audiovisual material, etc. on 6 h. projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams **EVALUATION SYSTEM** w MAKE-UP MECHANISMS Presentation and defence of exercises, case studies, 100% Reports on the completion of exercises, case studies, computer computer practical work, simulation practical work, exercises, simulation exercises, laboratory exercises, term laboratory practical work, term projects, end of degree projects, challenges and problems project, master's thesis, challenges and problems Comments: Continuous evaluation. FEEDBACK received from the Comments: Students have the responsability of meeting the tutor tutor in the semester project follow-up meetings. to do the tracking of the project and to ensure the achievement of the goals. CH - Class hours: 2 h. NCH - Non-class hours: 4 h. TH - Total hours: 6 h. RGM334 [!] Analiza y dimensiona elementos que trabajan bajo cargas cíclicas СН NCH ΤΗ LEARNING ACTIVITIES Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in 5 h. 22 h. 27 h. interdisciplinary contexts, real and/or simulated, individually and/or in teams **EVALUATION SYSTEM** w MAKE-UP MECHANISMS Reports on the completion of exercises, case studies, 40% Individual written and/or oral tests or individual computer exercises, simulation exercises, laboratory coding/programming tests exercises, term projects, challenges and problems Individual written and/or oral tests or individual 60% coding/programming tests CH - Class hours: 5 h. NCH - Non-class hours: 22 h. TH - Total hours: 27 h. 2RGM390 (2 sem) СН NCH ΤΗ LEARNING ACTIVITIES Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in 4 h. 4 h. interdisciplinary contexts, real and/or simulated, individually and/or in teams **EVALUATION SYSTEM** w MAKE-UP MECHANISMS Reports on the completion of exercises, case studies, 100% Reports on the completion of exercises, case studies, computer computer exercises, simulation exercises, laboratory exercises, simulation exercises, laboratory exercises, term exercises, term projects, challenges and problems projects, challenges and problems

Comments: Students have the responsability of meeting the tutor to do the tracking of the project and to ensure the achievement of the goals.

Comments: Continuous evaluation. FEEDBACK received from the tutor in the semester project follow-up meetings.

CH - Class hours: 0 h. NCH - Non-class hours: 4 h. TH - Total hours: 4 h.

RGM332 [!] Comprende los fundamentos de los principales fenómenos de degradación que pueden experimentar los materiales en uso y define las posibles soluciones de diseño, para mejorar su comportamiento en servicio



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LEARNING ACTIVITIES	СН	NCH	ТН		
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning				8 h.	10 h.
Carrying out/resolving projects/challenges/cases, etc. to interdisciplinary contexts, real and/or simulated, individu	2 h.	4 h.	6 h.		
Presentation by the teacher in the classroom, in particip procedures associated with the subjects	12 h.		12 h.		
Carrying out exercises and solving problems individually and/or in teams				3 h.	5 h.
EVALUATION SYSTEM W MAKE-UP MECHANIS					
Individual written and/or oral tests or individual 100% Individual written and/or coding/programming tests coding/programming tests			r oral tests sts	or individual	
CH - Class hours: 18 h. NCH - Non-class hours: 15 h. TH - Total hours: 33 h.					

CONTENTS

1. Composite materials1.1. Introduction1.2. Classification1.3. Raw materials1.4. Mechanical behaviour1.5. Transformation processes1.6. Current challenges and new trends2. Degradation ofmaterials2.1. Corrosion of materials2.2. Wear of materials2.3. Surface engineering2.4. Fatigue3. Materials selection3.1. Stainless steels3.2. Aluminium alloys3.3. magnesium alloys3.4. titanium alloys3.5. Sustainability3.6. Methodology of material selection

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Video projections	"Matériaux composites à matrice organique"; G. Chrétien; Technique
Slides of the subject	et Documentation (Lavoisier); Paris, 1986
Technical articles	"Matériaux composites à matrice organique"; G. Chrétien; Technique
Presentations by external Lecturers	et Documentation (Lavoisier); Paris, 1986 Kendu "Materials Science
Class presentations	and sons; 9th edition; 2011
Specific Master Software	"Introduction to Materials Science for Engineers": J.F. Shackelford:
Voodle Platform	Pearson Education Limited; 2016
Topic related web quires	A practical Guide to Composites. 1995. Multisport Composites
Labs	Limited, Bolton.
	Materials selection in mechanical design / Michael F. Ashby. Butterworth-Heinemann. 2017.
	ASM Metal Handbooks
	Ralph I. Stephens; Ali Fatemi; Robert R. Stephens; O. Fuchs, Metal Fatigue in Engineering. John Wiley & Sons, Inc, 2001.
	Jaap Schijve, Fatigue of Structures and Materials. Springer, 2009
	P.G. Forrest, Fatiga de los metales. Ediciones URMO, 1972
	https://www.grantadesign.com/education/students/