

## SUBJECT TEACHING GUIDE

1119 - Advanced explosives

Master's Degree in mining engineering

Academic year 2023-2024

1. IDENTIFYING DATA					
Degree	Master's Degree in mining engineering			Type and Year	Compulsory. Year 2
Faculty	School of Mines and Energy Engineering				
Discipline	MINING				
Course unit title and code	1119 - Advanced explosives				
Number of ECTS credits allocated	3	Term	Semester based (1)		
Web					
Language of instruction	Spanish	English Friendly	Yes	Mode of delivery	Face-to-face

Department	DPTO. TRANSPORTES Y TECNOLOGIA DE PROYECTOS Y PROCESOS				
Name of lecturer	RUBEN PEREZ ALVAREZ				
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Other lecturers					

### 3.1 LEARNING OUTCOMES

- By passing this subject, the student will master the technology of explosives and pyrotechnic materials.

### 4. OBJECTIVES

The objectives of this subject consist of providing the student specific training about explosives and pyrotechnic elements, considering both the user's and manufacturer's approaches. The student will gain knowledge about the legal framework (paying special attention to safety issues), special types of blasts, the mitigation of undesired effects of blasting, and current trends in the field of explosives.

6. COURSE ORGANIZATION	
CONTENTS	
1	<p>INTRODUCTION</p> <p>Fundamentals of explosives technology.</p> <p>Main types of explosives.</p> <p>Accessories.</p>
2	<p>LEGAL FRAMEWORK IN SPAIN</p> <p>Mining Safety Standards (Reglamento General de Normas Básicas de Seguridad Minera) and Complementary Technical Instructions.</p> <p>Regulation of Explosives.</p>
3	<p>SPECIAL TYPES OF BLASTS AND THEIR DESIGN.</p> <p>Production Blasts.</p> <p>Large Blasts.</p> <p>Large Displacement Blasts.</p> <p>Underwater Blasts.</p> <p>Demolitions.</p>
4	<p>SAFETY AND MINIMIZATION OF ADVERSE EFFECTS.</p> <p>Projections.</p> <p>Vibrations.</p> <p>Aerial Wave.</p> <p>Safe use of explosives.</p>
5	<p>BLASTING PROJECTS.</p> <p>The blasting project.</p> <p>Permissions.</p>
6	<p>NEW TECHNOLOGIES.</p> <p>Application of new technologies to the design, optimization and execution of blasts.</p> <p>Calculation software and simulators.</p> <p>Fragmentation Optimisation, "Mine-to-Mill" concept.</p>
7	<p>EXPLOSIVES AND PYROTECHNIC MATERIALS MANUFACTURING AND MANAGEMENT.</p> <p>Legal Framework.</p> <p>Raw materials.</p> <p>Classification.</p> <p>Handling and use.</p> <p>Testing and Certification.</p> <p>Expiry.</p> <p>Disposal.</p> <p>Transport.</p> <p>Safety.</p>

## 7. ASSESSMENT METHODS AND CRITERIA

Description	Type	Final Eval.	Reassessn	%
Final Exam of Contents	Written exam	Yes	Yes	60,00
Group Essay.	Work	No	Yes	15,00
Individual Essay.	Work	No	Yes	15,00
Individual resolution of exercises	Others	No	Yes	10,00
<b>TOTAL</b>				<b>100,00</b>
<b>Observations</b>				
<p>In order to pass the subject, the student will be required to get a minimum score of 4.5/10 in the Final Exam of Contents, and an average global score of 5/10. If these requirements are not satisfied, the final score will be obtained as the weighted average of the different items of evaluation, until a maximum of 4.9. Any passed item would be kept for the extraordinary evaluation.</p> <p>The final exam will be held on-site. However, if Health and Educational Authorities suspended in-class activities, it will be developed through Moodle, and monitored with Teams.</p>				
<b>Observations for part-time students</b>				
<p>Part-time students will be evaluated according the Normative of University of Cantabria.</p> <p>In addition to the requirement of passing the Final Exam of Contents, and given the characteristics of the activities proposed for the continuous evaluation, part time students will be subject to them as the rest of students. However, the Group Essay could be replaced by an Individual Essay about the same topic if the part-time student required it.</p>				

## 8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC
Ríos Vázquez, J. Curso Básico de Explosivos. Oviedo: Fundación Luis Fernández Velasco. 2009.
Explosivos y accesorios. Madrid: UEE. 1990.
Destrucción de explosivos industriales. Madrid: UEE. 1990.
Manual de empleo de explosivos. Madrid: UEE. 2003.
Carmona Pastor, F. Transporte de Mercancías Peligrosas. Explosivos. Madrid: Díaz de Santos. 2002.
Bernaola Alonso, J. Fundamentos de diseño de Voladuras. Madrid: Fundación Gómez Pardo. 2008.
Blasters' Handbook, 18 th Edition. Cleveland: International Society of Explosives Engineers. 2011.
Johansen, J. in association with Mathiesen, C.F. Modern trends in tunnelling and blast design. Rotterdam: A.A. Balkema. 2000.
Langa Fuentes, E. Demoliciones por voladura. Madrid: Fueyo. 2011.
Reglamento general de normas básicas de seguridad minera e instrucciones técnicas complementarias (ITC) : SMI / Ministerio de Industria, Turismo y Comercio.
Plá Ortiz de Urbina, F., Mecía Andrés, L. y López Jimeno, C. Perforación y voladura. Madrid: Fundación Gómez Pardo. 1978.
Sanchidrián Blanco, J.A y Muñoz, E. Curso de Tecnología de Explosivos. Madrid: Fundación Gómez Pardo. 2000.
Urbanski, T. Chemistry and Technology of Explosives. Oxford: Pergamon; Warszawa: PWN Polish Scientific Publishers. 1965.
Reglamento General de Explosivos e ITCs. (Recurso on-line: <a href="http://www.boe.es/buscar/pdf/2017/BOE-A-2017-2313-consolidado.pdf/RD230_1998.%20ReglamentodeExplosivos%20(texto%20consolidado).pdf">http://www.boe.es/buscar/pdf/2017/BOE-A-2017-2313-consolidado.pdf/RD230_1998.%20ReglamentodeExplosivos%20(texto%20consolidado).pdf</a> )
Apuntes proporcionados al comienzo del curso.

