



## Teaching Guide

Identifying Data					2024/25
Subject (*)	Applications Security	Code	614530104		
Study programme	Máster Universitario en Ciberseguridade				
Descriptors					
Cycle	Period	Year	Type	Credits	
Official Master's Degree	1st four-month period	First	Obligatory	5	
Language	Spanish				
Teaching method	Face-to-face				
Prerequisites					
Department	Ciencias da Computación e Tecnoloxías da InformaciónComputaciónTecnoloxías da Información e as Comunicaci3ns				
Coordinador	Bellas Permuy, Fernando	E-mail	fernando.bellas@udc.es		
Lecturers	Bellas Permuy, Fernando Losada Perez, Jose	E-mail	fernando.bellas@udc.es jose.losada@udc.es		
Web	moovi.uvigo.gal				
General description	Developing secure applications is not an easy task. Knowledge of the vulnerabilities that usually affect applications, the techniques of authentication, authorization and access control, as well as the incorporation of security into the development life cycle, is essential to be able to build and maintain applications successfully. In this course, all these aspects are studied in a practical way, with special emphasis on the development of web applications and services.				

## Study programme competences / results

Code	Study programme competences / results
A2	CE2 - Deep knowledge of cyberattack and cyberdefense techniques
A7	CE7 - To demonstrate ability for doing the security audit of systems, equipment, the risk analysis related to security weaknesses, and for developing de procedures for certification of secure systems
A13	CE13 - Ability for analysing, detecting and eliminating software vulnerabilities and malware capable to exploit those in systems or networks
A24	HD-04 - Prevenir, identificar y corregir las principales vulnerabilidades que sufren las aplicaciones, así como incorporar mecanismos de autenticaci3n, autorizaci3n y control de acceso a las aplicaciones
B2	CB2 - Students will be able to apply their knowledge and their problem-solving ability in new or less familiar situations, within a broader context (or in multi-discipline contexts) related to their field of specialization
B7	CG2 - Ability for problem-solving. Ability to solve, using the acquired knowledge, specific problems in the technical field of information, network or system security
B20	K-04 - Distinguir las principales vulnerabilidades que sufren las aplicaciones, así como los principales mecanismos de autenticaci3n, autorizaci3n y control de acceso, con énfasis especial en aplicaciones web y servicios web
C4	CT4 - Ability to ponder the importance of information security in the economic progress of society
C8	C-03 - Trabajar como analista de malware, para proteger aplicaciones, así como analizar su seguridad en cualquier área de aplicaci3n
C19	C-14 - Proyectar, modelar, calcular y diseñar soluciones técnicas y de gesti3n de seguridad de la informaci3n, las redes y/o los sistemas de comunicaciones en todos los ámbitos de aplicaci3n, con criterios éticos de responsabilidad y deontología profesional

## Learning outcomes

Learning outcomes	Study programme competences / results		
To know the vulnerabilities that applications usually suffer (with special emphasis on web applications and services) and prevention mechanisms.	AJ2	BJ2	CJ4
	AJ7	BJ7	CJ8
	AJ13	BJ20	CJ19
	AJ24		



To know the techniques of authentication, authorization and access control in applications and services.	AJ2	BJ2	CJ4
	AJ7	BJ7	CJ8
	AJ13	BJ20	CJ19
	AJ24		

Contents	
Topic	Sub-topic
Topic 1. Introduction.	1.1 Authentication, authorization and access control. 1.2 Stateful applications and services. 1.3 Stateless applications and services. 1.4 Server-side and SPA web applications.
Topic 2. Vulnerabilities and prevention mechanisms in applications and services.	2.1 Reference frameworks. 2.2 Vulnerabilities in the processing of input data. 2.3 Vulnerabilities in authentication. 2.4 Vulnerabilities in session management. 2.5 Sensitive data exposure. 2.6 Vulnerabilities in access control. 2.7 Incorrect configuration. 2.8 Monitoring and insufficient logging. 2.9 Vulnerabilities in third-party libraries.
Topic 3. Secure software development life cycles.	3.1 Security from the analysis phase. 3.2 Code revisions. 3.3 SAST and DAST tools.
Topic 4. Authentication, authorization and access control.	4.1 Introduction. 4.2 Authentication and authorization. 4.2.1 HTTP authentication. 4.2.2 JSON Web Token. 4.2.3 OAuth. 4.2.4 OpenID Connect. 4.2.5 Other standards. 4.3 Access control. 4.3.1 Role-based access control (RBAC). 4.3.2 Attribute-based access control (ABAC).

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student's personal work hours	Total hours
Guest lecture / keynote speech	A2 A7 A13 A24 B2 B7 B20 C4 C8 C19	24	24	48
ICT practicals	A2 A7 A13 A24 B2 B7 B20 C4 C8 C19	18	47	65
Multiple-choice questions	A2 A7 A13 A24 B2 B7 B20 C4 C8 C19	2	8	10
Personalized attention		2	0	2

(\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description



Guest lecture / keynote speech	Lessons taught by the teacher through the projection of slides. Lessons have a totally practical approach, explaining the theoretical concepts through the use of simple examples and case studies. Slides are available on the e-learning platform of the university.
ICT practicals	To experiment with the concepts studied in the course, students will perform two projects. The first one will be focused on the vulnerability analysis of a web application. Students will start from the source code of a web application and will have to detect the vulnerabilities, exploit them and fix them. The second project will be focused on authentication, authorization and access control. Students will start from the source code of an application, composed of a user interface and a service, and will have to implement authentication, authorization and access control, by following different strategies.
Multiple-choice questions	There will be a test to verify students have assimilated concepts correctly. The test will consist of a set of questions with several possible answers, being only one of them correct. Unanswered questions do not score, and wrong answers score negatively.

### Personalized attention

Methodologies	Description
ICT practicals	<p>Tutorials and questions by email and Teams for specific doubts.</p> <p>Tutorial timetables:</p> <ul style="list-style-type: none"> <li>- UDC teachers: <a href="https://www.udc.es/gl/centros_departamentos_servizos/centros/titorias/?codigo=614">https://www.udc.es/gl/centros_departamentos_servizos/centros/titorias/?codigo=614</a>.</li> <li>- UVIGO teachers: <a href="https://moovi.uvigo.gal/user/profile.php?id=11662">https://moovi.uvigo.gal/user/profile.php?id=11662</a>.</li> </ul> <p>Presence of the teacher in the lab to assist students in the development of lab projects.</p>

### Assessment

Methodologies	Competencies / Results	Description	Qualification
ICT practicals	A2 A7 A13 A24 B2 B7 B20 C4 C8 C19	Completion of the two projects is mandatory.	60
Multiple-choice questions	A2 A7 A13 A24 B2 B7 B20 C4 C8 C19	There will be a test to verify students have assimilated concepts correctly.	40

### Assessment comments

<p>To pass the course, it is necessary to obtain:</p> <p>4 points at least (out of 10) in the evaluation of each project. 4 points at least (out of 10) in the test. 5 points at least (out of 10) in the final mark, which is calculated as follows: <math>0.60 * (0.70 * \text{project1} + 0.30 * \text{project2}) + 0.40 * \text{exam}</math>. Marks of projects and the test are saved from the first call to the second call (extraordinary at UVIGO).</p>
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### Sources of information

Basic	<p>Open Web Application Security Project (OWASP), <a href="https://www.owasp.org">https://www.owasp.org</a>. Common Weakness Enumeration (CWE), <a href="https://cwe.mitre.org">https://cwe.mitre.org</a>. Common Vulnerabilities and Exposures (CVE), <a href="https://cve.mitre.org">https://cve.mitre.org</a>. National Vulnerability Database (NVD), <a href="https://nvd.nist.gov">https://nvd.nist.gov</a>. Common Attack Pattern Enumeration and Classification (CAPEC), <a href="https://capec.mitre.org">https://capec.mitre.org</a>. JSON Web Token (JWT), <a href="https://jwt.io">https://jwt.io</a>. OAuth, <a href="https://oauth.net">https://oauth.net</a>. OpenID Connect, <a href="http://openid.net/connect/">http://openid.net/connect/</a>. Open Web Application Security Project (OWASP), <a href="https://www.owasp.org">https://www.owasp.org</a>. Common Weakness Enumeration (CWE), <a href="https://cwe.mitre.org">https://cwe.mitre.org</a>. Common Vulnerabilities and Exposures (CVE), <a href="https://cve.mitre.org">https://cve.mitre.org</a>. National Vulnerability Database (NVD), <a href="https://nvd.nist.gov">https://nvd.nist.gov</a>. Common Attack Pattern Enumeration and Classification (CAPEC), <a href="https://capec.mitre.org">https://capec.mitre.org</a>. JSON Web Token (JWT), <a href="https://jwt.io">https://jwt.io</a>. OAuth, <a href="https://oauth.net">https://oauth.net</a>. OpenID Connect, <a href="http://openid.net/connect/">http://openid.net/connect/</a>.</p>
Complementary	



Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments

(\*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.