



IDENTIFYING DATA

Advanced software engineering methods

Subject	Advanced software engineering methods			
Code	O06G150V01949			
Study programme	(*)Grao en Enxeñaría Informática			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st
Teaching language	#EnglishFriendly Spanish Galician English			
Department				
Coordinator	Gómez Rodríguez, Alma María			
Lecturers	Gómez Rodríguez, Alma María Rodríguez Martínez, Francisco Javier			
E-mail	alma@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	<p>The subject has character of introduction and deepening in the utilization of mathematical based methods for the definition and construction of software systems.</p> <p>English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.</p> <p>Na materia tratarase de coñecer os principais métodos formais de definición e refinamiento de programas. As prácticas da materia impartiranse en inglés, quedando o castelán e galego reservados para o ámbito teórico.</p>			

Competencies

Code	
A2	Students will be able to apply their knowledge and skills in their professional practice or vocation and they will show they have the required expertise through the construction and discussion of arguments and the resolution of problems within the relevant area of study.
A4	Students will be able to present information, ideas, problems and solutions both to specialist and non-specialist audiences.
B2	Ability to manage the project's activities from the computing field in accordance with the acquired knowledge and training.
B9	Ability to solve problems by taking the initiative, making decisions and acting independently and creatively. Ability to communicate the knowledge contents, skills and abilities of the Computer Science Engineer profession.
B10	Ability to carry out measurements, calculus, assessments, valuations, expert's reports, studies, reports, task planning and other analogous computing jobs, according to the knowledge and training acquired.
C8	Ability to plan, conceive, implement and manage computing projects, services and systems in every area, monitoring their implementation and their continuing improvement and assessing their economic and social impact.
C13	Knowledge, design and efficient use of the most appropriate data structures and types for the resolution of a problem.
C26	Ability to assess clients' needs and determine the software requirements to satisfy these needs, reconciling conflicting goals through attempts to reach acceptable compromises within the limits imposed by costs, available times, existing developed systems and organizations themselves.
C29	Ability to identify, assess and deal with associated risks that could potentially arise.
C32	Ability to select, design, implement, integrate, assess, build, manage, exploit and maintain hardware, software and network technologies, within the appropriate costs and quality requirements.
C35	Ability to select, design, implement, integrate and manage information systems that meet the needs of organizations, once the costs and quality criteria have been identified.
C36	Ability to design systems, applications and services based on network technologies, including the Internet, web, e-commerce, multimedia, interactive services and mobile computing.
D4	Analysis, synthesis and evaluation capacity

D6 Ability to abstract: ability to create and use models that reflect real situations

D7 Ability to search, relate and structure information from various sources and to integrate ideas and knowledge.

D10 Interpersonal relationship skills.

D11 Critical thinking

Learning outcomes

Expected results from this subject	Training and Learning Results			
RA1: Know and comprise the main characteristics of the formal methods applied to the tasks of Software Engineering.	A4	B10	C8 C26 C35	D4 D11
RA2: Comprise the importance to use a formal approach in the development of software of quality.	A2	B2	C29 C32 C35	D4 D7 D11
RA3: Specify and model the requests exposed by users using a formal languages of specification.	A2	B2 B9 B10	C8 C13 C26 C29 C35 C36	D6 D10
RA4: Understand how the formal specification languages allow the mathematical verification of the specification and facilitate the automatic code generation.		B10	C29 C35	D7 D11
RA5: Use properly the tools of formal models in the activities of software specification.	A2	B2 B9	C8 C13 C35 C36	
RA6: Comprise the concepts associated to formal verification		B10	C29	D7
RA7: Be able of validating a software application formally described.	A2	B2 B10	C29 C35 C36	D6 D7

Contents

Topic

INTRODUCTION	Deficiencies of less formal approaches. Concepts of formal methods. Formal methods commandments.
SOFTWARE FORMAL MODELING.	Basic concepts. Logical bases. Languages for formal specification: Z, VDM... The language of specification: Z. Formal definitions in Z. Basic Types. Diagrams. Sets. Relations. Functions. Sequences. Bags. Operations. Formal proof: Initiation theorem and Preconditions.
FORMAL VERIFICATION	Code and Specification Application to the life-cycle.
DEVELOPMENT PROCESS WITH FORMAL TECHNIQUES	Changes in the cycle of life owed to the utilization of formal methods Applications of formal techniques. Clean Room software engineering.

Planning

	Class hours	Hours outside the classroom	Total hours
Problem solving	15	30	45
Mentored work	5.5	15.5	21
Presentation	6	12	18
Lecturing	23	0	23
Objective questions exam	1.5	20	21.5
Essay questions exam	1.5	20	21.5

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

Methodologies	
	Description
Problem solving	Application to practical exercises of the theoretical methods .
Mentored work	To promote the autonomous learning of students, under the tutelage of the teacher in various scenarios (academic and professional). It is primarily about learning "how to do things." It is an option based on students taking responsibility for their own learning. It is based on the independent learning of students and the monitoring of that learning by the teacher-tutor.
Presentation	Group work technique for the purpose of intensive study of a topic. The final result must be a document setting out the conclusions reached. Then the students will make a verbal presentation in which they present issues, works, concepts, facts or principles in a dynamic way; subjected to questions from classmates and the teacher.
Lecturing	Learning the theoretical contents through the use of blackboard, audiovisual media, etc.

Personalized assistance

Methodologies	Description
Mentored work	The student will be provided with followup to carry out the tasks entrusted.

Assessment

Description		Qualification Training and Learning Results					
Mentored work	It will consist of the development of a practical project of autonomous form, and the defense before the professor of the student. This assessment method is associated with learning outcomes: RA3 and RA5.	20	A2	B2	C13	D7	
				B9	C26	D11	
				B10	C29		
					C35		
					C36		
Presentation	It will be carried out in workgroups. This method of evaluation is associated with learning outcomes: RA1, RA2, RA4.	30	A2	B2	C8	D6	
			A4	B10	C13	D10	
					C26		
					C29		
					C32		
					C35		
					C36		
Objective questions exam	It will consist of several tests throughout the course, which will also allow monitoring of the student's evolution. This method of evaluation is associated with the learning outcomes: RA1, RA2, RA6, RA7.	25	A2	B10	C8	D6	
					C32	D7	
					C35		
					C36		
Essay questions exam	The proof will consist of theoretical questions and exercises that the student has to develop to demonstrate the acquired knowledge. This method of evaluation is associated with the learning outcomes: RA1, RA2, RA3, RA5, RA6, RA7.	25	A2	B9	C13	D7	
					C35	D11	

Other comments on the Evaluation

EVALUATION CRITERIA FOR ASSISTANTS 1st EDITION OF ACTS

All students who attend any of the tests are considered to be in attendance and therefore must follow the evaluation procedure previously described.

EVALUATION CRITERIA FOR NOT ASSISTANTS OR FOR THE 2nd AND FOLLOWING EDITIONS OF ACTS

For students who do not attend the classes, and in the second and following editions of acts, the examination will consist on a written exam where all the competences of the subject will be evaluated.

PROCESS FOR THE CALIFICATION OF ACTS

The grade for assistants will be based on the previously described teaching methodologies. In any case, a minimum of 4 is required in each of the methodologies to pass the subject. In the event that this minimum rating is not achieved, the grade contained in the acts will be the lower of these two values:

- The obtained by the application of the weighting of the evaluation methods.

- The fixed value of 4.

EVALUATION DATES

The assessment dates will be those approved by the ESEI and published on the official website. The examination calendar officially approved by the ESEI is published on the website <http://www.esei.uvigo.es/index.php?id=29>

Sources of information

Basic Bibliography

Pressman, Roger S., **Ingeniería del Software: Un enfoque práctico**, 9786071503145, 7, McGraw-Hill, 2010

Spivey, J.M., **Understanding Z : a specification language and its formal semantics**, 9780521334297, 1, Prentice-Hall, 1988

Woodcock, Jim, **Using Z [Recurso de Internet] : specification, refinement, and proof**, 978-0139484728, 1, 1996

Complementary Bibliography

Rosalind Barden, Susan Stepney, and David Coope, **Z in Practice**, 9780131249349, 1, Prentice-Hall, 1994

John J. Marciniak, **Encyclopedia of software engineering**, 978-0471210085, 1, John Wiley & Sons, 1994

Guttag & Horning, **Larch: Languages and tools for Formal Specification**, 978-1-4612-2704-5, 1, Springer-Verlag, 1993

<http://vl.fmnet.info/>, **Página de métodos formais.**,

<http://vl.zuser.org/>, **Página de Z,**

Recommendations

Subjects that it is recommended to have taken before

Software engineering I/O06G150V01304

Software engineering 2/O06G150V01403

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===

In front of it uncertain and unpredictable evolution of the sanitary alert caused by the COVID- 19, the University establishes join extraordinary planning that will actuate in the moment in that the administrations and the institution determine, attending to criteria of security, health and responsibility, and guaranteeing the continuity of classes in a non-assistant or no totally assistant scenario. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the classes in an quick and effective way when being known beforehand (or with a wide advance) pole students and the teaching staff through the tool normalized and institutionalized of the teaching guides DOCNET.

=== ADAPTATION OF The METHODOLOGIES ===

In case emergency, the methodologies and proofs of evaluation would be maintained. The way of doing such the evaluation test would change to be done on-line, by means of the most adequate technical methods.