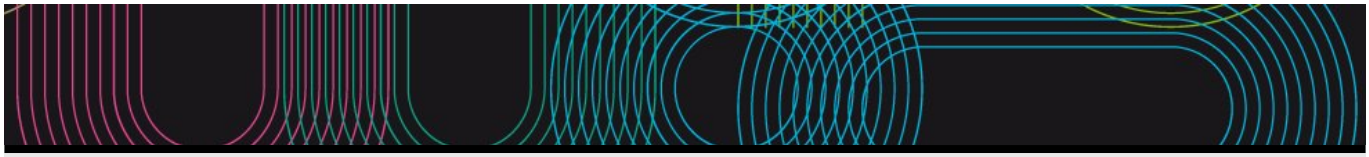

| IDENTIFYING DATA | | | | |
|---|---|---|---|---|
| **Advanced software engineering methods** | | | | |
| Subject | Advanced software engineering methods | | | |
| Code | O06G150V01949 | | | |
| Study programme | (*)Grao en Enxeñaría Informática | | | |
| Descriptors | ECTS Credits | Choose | Year | Quadmester |
| | 6 | Optional | 4th | 1st |
| Teaching language | #EnglishFriendly<br>Spanish<br>Galician<br>English | | | |
| Department | | | | |
| Coordinator | Gómez Rodríguez, Alma María | | | |
| Lecturers | Borrajo Diz, María Lourdes<br>Gómez Rodríguez, Alma María<br>Rodríguez Martínez, Francisco Javier | | | |
| E-mail | alma@uvigo.es | | | |
| Web | http://faitic.uvigo.es | | | |
| General description | The subject has character of introduction and deepening in the utilization of mathematical based methods for the definition and construction of software systems.<br>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.<br>Na materia tratarase de coñecer os principais métodos formais de definición e refinamiento de programas.<br>As prácticas da materia impartiranse en inglés, quedando o castelán e galego reservados para o ámbito teórico. | | | |

| 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. |
| 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. |
| C5 | Knowledge of the structure, organization, functioning and interconnection of computing systems, the foundations of their programming, and their application to the resolution of specific problems in engineering. |
| 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. |
| C12 | Knowledge and application of basic algorithmic procedures of computer technologies to design solutions to problems, analyzing the appropriacy and complexity of the proposed algorithms. |
| 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. |
| D1 | I1: Analysis, synthesis and assessment skills. |
| D3 | I3: Oral and written communication skills in one's native language. |
| D5 | I5: Abstraction skills: ability to create and use models that reflect real situations. |
| D7 | I7: Ability to search for, establish links and organize information coming from different sources and to integrate ideas, knowledge and skills. |
| D9 | I9: Ability to make decisions. |
| D10 | I10: Ability to present arguments and justify one's decisions and opinions in logical terms. |
| D15 | P5: Interpersonal relations skills. |
| D16 | S1: Critical-thinking skills. |
| D18 | S3: Independent-learning skills. |
| D19 | S4: Ability to adapt to new situations. |
| D20 | S5: Creativity. |
| D22 | S7: Ability to take the initiative and be determined. |

## Learning outcomes

| Expected results from this subject | Training and Learning Results | | | |
|---|---|---|---|---|
| New | A4 | B10 | C8<br>C12<br>C26<br>C35 | D3<br>D9<br>D15 |
| New | A2 | | C29<br>C32<br>C35 | D1<br>D3<br>D16 |
| New | | B2<br>B10 | C5<br>C13<br>C26<br>C29<br>C35<br>C36 | D5<br>D9<br>D10 |
| New | | B10 | C29<br>C35 | D1<br>D5<br>D10<br>D18<br>D19 |
| New | A2 | B2 | C5<br>C8<br>C13<br>C35<br>C36 | D1<br>D5<br>D16<br>D20<br>D22 |
| New | | B10 | C29 | D7<br>D16 |
| New | | B10 | C12<br>C29 | D9<br>D16 |

## Contents

| Topic | |
|---|---|
| INTRODUCTION | Deficiencies of less formal approaches.<br>Concepts of formal methods.<br>Formal methods commandments. |
| SOFTWARE FORMAL MODELING. | Basic concepts.<br>Logical bases.<br>Languages for formal specification: Z, VDM...<br>The language of specification: Z.<br>Formal definitions in Z.<br>Basic Types.<br>Diagrams.<br>Sets.<br>Relations.<br>Functions.<br>Sequences.<br>Bags.<br>Operations.<br>Formal proof: Initialition theorem and Preconditions. |

| | |
|---|---|
| FORMAL VERIFICATION | Code and Specification<br>Application to the life-cycle. |
| DEVELOPMENT PROCESS WITH FORMAL TECHNIQUES | Changes in the cycle of life owed to the utilization of formal methods<br>Applications of formal techniques.<br>Clean Room software engineering. |

## Planning

| | Class hours | Hours outside the classroom | Total hours |
|---|---|---|---|
| Problem solving | 15 | 30 | 45 |
| Mentored work | 5 | 15 | 20 |
| Presentation | 6 | 12 | 18 |
| Lecturing | 22 | 33 | 55 |
| Objective questions exam | 1.5 | 4.5 | 6 |
| Essay questions exam | 1.5 | 4.5 | 6 |

*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 | (*)Aplicación dos contidos teóricos a exercicios prácticos semellantes aos que se atoparían no traballo profesional. |
| Mentored work | (*)Para promover a aprendizaxe autónoma dos estudantes, baixo a tutela do profesor en escenarios variados (académicos e profesionais). Está referida prioritariamente a aprendizaxe de □como facer as cousas□. Constitúe unha opción baseada na asunción polos estudantes da responsabilidade pola súa propia aprendizaxe. Baséase na aprendizaxe independente dos estudantes e o seguimento desa aprendizaxe polo profesor-titor. |
| Presentation | (*)Técnica de traballo en grupo coa finalidade do estudo intensivo dun tema. O resultado final deberá ser un documento no que se plasmen as conclusións ás que se chegou. A continuación o alumnado realizará unha exposición verbal en preséntana cuestións, traballos, conceptos, feitos ou principios de forma dinámica; sometido ás preguntas dos compañeiros e do profesor. |
| Lecturing | (*)Aprendizaxe dos contidos teóricos mediante o emprego da lousa, medios audiovisuais, 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.<br>This assessment method is associated with learning outcomes: RA3 and RA5. | 20 | A2 | B10 | C5<br>C8<br>C12<br>C13<br>C26<br>C35<br>C36 | D1<br>D3<br>D5<br>D9<br>D16<br>D18<br>D20<br>D22 |
| Presentation | It will be carried out in workgroups. This method of evaluation is associated with learning outcomes: RA1, RA2, RA4. | 30 | A4 | | C8 | D1<br>D3<br>D7<br>D15<br>D16<br>D20<br>D22 |
| 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 | B2 | C12<br>C32 | D7<br>D9<br>D18 |
| 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 | A4 | B10 | C5<br>C29<br>C32 | D1<br>D3<br>D10<br>D16<br>D18<br>D19 |

## 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**, 7, McGraw-Hill, 2010

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

Woodcock, Jim, **Using Z [Recurso de Internet] : specifcation, refinement, and proof**, 1, 1996


### Complementary Bibliography


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

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

Guttagg & Horning, **Larch: Languages and tools for Formal Specification**, 1, Springer-Verlag, 1993

http://vl.fmnet.info/, **Páxina de métodos formais.**,

http://vl.zuser.org/, **Páxina de Z**,


## Recommendations

### Subjects that it is recommended to have taken before

Software engineering I/O06G150V01304

Software engineering 2/O06G150V01403