IDENTIFYING DATA

Architectural design of large software systems

Subject	Architectural design of large software systems
Code	O06G151V01407
Study programme	Grado en Ingeniería Informática

Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	1st

Teaching language	#EnglishFriendly Spanish Galician
Department	
Coordinator	Ribadas Pena, Francisco José González Peña, Daniel
Lecturers	González Peña, Daniel Ribadas Pena, Francisco José
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General description	This subject covers all software engineering lifeciclye but it is focused on complex, high-dimension, software systems design. In this kind of systems, techniques and usual software engineering tools require a greater degree of complexity in the distribution of tasks and in its general aims. Diverse and necessary aptitudes needed to focus complex software systems development from a component-oriented point of view are discussed with an industrial production perspective (software factories). 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.

Training and Learning Results

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.
A3	Students will be able to gather and interpret relevant data (normally within their field of study) that will allow them to have a reflection-based considered opinion on important issues of social, scientific and ethical nature.
A4	Students will be able to present information, ideas, problems and solutions both to specialist and non-specialist audiences.
A5	Students will acquire the learning skills that are required to pursue further studies with a high degree of independence.
B1	Ability to conceive, write, organize, plan, develop and sign projects in the field of computing engineering whose aim is, according to the acquired knowledge and training, the design, development and exploitation of computing systems, services and applications.
B5	Ability to conceive, develop and maintain computing systems, services and applications through use of software engineering methods as tools to ensure quality, according to the knowledge and training acquired.
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.
C13	Knowledge, design and efficient use of the most appropriate data structures and types for the resolution of a problem.
C19	Knowledge and application of the necessary tools for storing, processing and accessing information Systems, including web-based ones.
C22	Knowledge and application of the principles, methodologies and life cycles of software engineering.
C25	Ability to develop, maintain and assess software systems and services that satisfy all the demands of users and work reliably and efficiently, are easy to develop and maintain, and meet the quality standards, applying the theories, principles, methods and practices of Software Engineering.
C27	Ability to solve problems of integration according to available strategies, standards and technologies.

C28	Ability to identify and analyze problems and design, develop, implement, verify and document software solutions on the basis of sound knowledge of the theories, models and techniques available nowadays.
C30	Ability to design appropriate solutions in one or more domains of application by using methods of software engineering that include ethical, social, legal and economic issues.
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.
D4	Analysis, synthesis and evaluation capacity
D5	Organizational and planning skills
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.
D8	Ability to work in situations of lack of information and / or under pressure
D9	Ability to quickly integrate and work efficiently in unidisciplinary teams and to collaborate in a multidisciplinary environment
D10	Interpersonal relationship skills.
D11	Critical thinking
D14	Have motivation for quality and continuous improvement

Expected results from this subject

Expected results from this subject	Training and Learning Results			
LA1: To know and to analyze the complexity of large software systems, effectively tackling each of their development phases	A2 A3 A4 A5	B1 B5 B9	C13 C19 C22 C25 C27 C28 C30 C32	D4 D5 D6 D7 D8 D9 D10 D11 D14
LO2: Distribute the work of each human team in charge of development among the different parts of the system	A2 A4	B1 B5 B9	C22 C30	D9
LO3: Being able to divide and structure any large software system into small pieces of software that can be treated independently	A2	B1 B5	C13 C22 C25 C27 C32	D4 D5 D6 D14
LO4: Validate and verify the integration of different components and software architectures in order to create large software systems	A2 A4	B1 B5	C22 C25 C27 C28 C32	D4 D11 D14
LO5: Guide the software development process according to an industrial point of view	A2	B1 B5 B9	C13 C19 C22 C25 C27 C28 C30 C32	D4 D5 D6 D10 D14
LO6: Know the specific software engineering techniques to deal with large software systems and large working teams	A2 A3 A4 A5	B1 B5	C22 C25 C28 C30	D4 D5 D7 D8 D11 D14

Contents

Topic	
Complex software systems analysis and design	Requisites gathering in complex software systems. High level of detail architecture design.

Component-oriented software analysis and design (COTS).

Distributed software elements analysis and design. |

Development technologies for complex software systems	Use of integration middlewares between components and subsystems. Specific software factories frameworks and methodologies.
Complex software testing	Validation, testing and deployment of complex software systems.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	13	34	47
Laboratory practical	24	36	60
Seminars	10	0	10
Presentation	0.5	9.5	10
Objective questions exam	3	0	3
Project	2	18	20

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

Methodologies

	Description
Lecturing	Theoretical contents presentation. With the aim to facilitate the understanding and increasing the student attention, diverse examples and exercises requiring his/her active participation will be included
Laboratory practical	Practical problems solving, including software programming related to subject contents. CONTINUOUS ASSESSMENT Character: mandatory Attendance: mandatory Minimum: There is no minimum GLOBAL ASSESSMENT Character: not mandatory Attendance: not mandatory
Seminars	Answering of general student questions and sharing of specific theoretical and/or practical problems related to the subject
Presentation	Topic elaboration and presentation in small groups, including oral presentation and proposal of practical applications

Personalized assistance

Tests	Description
Project	Teacher will assist the student at the laboratory during assesable project development, by answering individual questions

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Regular attendance to the laboratory and participation (question answering, etc.) EXPECTED RESULTS IN THE SUBJECT BEING EVALUATED: LO1, LO2, LO3, LO4, LO5, LO6	5	A4 A5	B9	C13 C30	D8 D9 D14
Presentation	Preparation and presentation in small groups of a topic, his oral presentation and practical examples. Clarity, quality and time adjustment of the presentation will be taken into account. EXPECTED RESULTS IN THE SUBJECT BEING EVALUATED: LO1, LO5, LO6	15	A3 A4	B1 B5 B9	C22 C25 C27 C28 C30	D4 D5 D6 D7 D8 D9 D10 D11 D14
Objective questions exam	Individual multiple-choice tests which include theoretical and practical contents of the subject EXPECTED RESULTS IN THE SUBJECT BEING EVALUATED: LO1, LO3, LO5, LO6	35	A3 A5	B5 B9	C13 C19 C22 C25 C28 C32	D6

Project	Project development integrating subject contents.	45	A2	B5	C19	D5
			A3	B9	C22	D6
	EXPECTED RESULTS IN THE SUBJECT BEING EVALUATED: LO1, LO2, LO3, LO4, LO5, LO6		A5		C25	D7
					C27	D11
					C28	
					C32	

Other comments on the Evaluation

CONTINUOUS ASSESSMENT SYSTEM

Assistance and participation in laboratory

Description: regular attendance and participation in the laboratory sessions (asking doubts about the work, etc.).

Applied methodology: laboratory practical.

% Qualification: 5%.

% Minimum: There is no required minimum.

Evaluated training and learning results: A4, A5, B9, C13, C30, D8, D9, D14.

Expected results in the subject being evaluated: LO1, LO2, LO3, LO4, LO5, LO6.

Oral presentation

Description: preparation and presentation in small groups of a topic, its oral exposition and application approach. The clarity of the exposure, the quality of the presentation and the adjustment to the maximum pre-established time will be taken into account.

Applied methodology: presentation.

% Qualification: 15%.

Minimum %: a grade equal to or greater than 3.5 points must be obtained.

Evaluated training and learning results: A3, A4, B1, B5, B9, C22, C25, C27, C28, C30, D4, D5, D6, D7, D8, D9, D10, D11, D14.

Expected results in the subject being evaluated: LO1, LO5, LO6.

Written exam 1

Description: written individual multiple choice test on the theoretical contents of the first part.

Applied methodology: objective questions exam.

% Qualification: 17.5%.

Minimum %: a grade equal to or greater than 3.5 points must be obtained.

Evaluated training and learning results: A3, A5, B5, B9, C13, C19, C22, C25, C28, C32, D6.

Expected results in the subject being evaluated: LO1, LO3, LO5, LO6.

Written exam 2

Description: written individual multiple choice test on the theoretical contents of the second part.

Applied methodology: objective questions exam.

% Qualification: 17.5%.

Minimum %: a grade equal to or greater than 3.5 points must be obtained.

Evaluated training and learning results: A3, A5, B5, B9, C13, C19, C22, C25, C28, C32, D6.

Expected results in the subject being evaluated: LO1, LO3, LO5, LO6.

Projects deliverable 1

Description: first delivery of the projects that integrate contents seen in the matter.

Applied methodology: project.

% Qualification: 22.5%.

Minimum %: a grade equal to or greater than 3.5 points must be obtained.

Evaluated training and learning results: A2, A3, A5, B5, B9, C19, C22, C25, C27, C28, C32, D5, D6, D7, D11.

Expected results in the subject being evaluated: LO1, LO2, LO3, LO4, LO5, LO6.

Projects deliverable 2

Description: second delivery of projects that integrate contents seen in the matter.

Applied methodology: project.

% Qualification: 22.5%.

Minimum %: a grade equal to or greater than 3.5 points must be obtained.

Evaluated training and learning results: A2, A3, A5, B5, B9, C19, C22, C25, C27, C28, C32, D5, D6, D7, D11.

Expected results in the subject being evaluated: LO1, LO2, LO3, LO4, LO5, LO6.

If a student does not take any of the tests, a grade of 0 will be assigned to it.

GLOBAL ASESSMENT SYSTEM

Procedure for choosing the global assessment modality: once the period of one month from the beginning of the semester has passed, a period of 10 working days will be enabled for the enrolled students to formally express their intention to be assessed under the global assessment system.

Written exam

Description: written individual multiple choice test on the theoretical contents.

Applied methodology: objective questions exam.

% Qualification: 40%.

Minimum %: a grade equal to or greater than 5 points must be obtained.

Evaluated training and learning results: A3, A5, B5, B9, C13, C19, C22, C25, C28, C32, D6.

Expected results in the subject being evaluated: LO1, LO3, LO5, LO6.

Projects deliverable 1

Description: first delivery of the projects that integrate contents seen in the matter.

Applied methodology: project.

% Qualification: 30%.

Minimum %: a grade equal to or greater than 5 points must be obtained.

Evaluated training and learning results: A2, A3, A5, B5, B9, C19, C22, C25, C27, C28, C32, D5, D6, D7, D11.

Expected results in the subject being evaluated: LO1, LO2, LO3, LO4, LO5, LO6.

Projects deliverable 2

Description: second delivery of projects that integrate contents seen in the matter.

Applied methodology: project.

% Qualification: 30%.

Minimum %: a grade equal to or greater than 5 points must be obtained.

Evaluated training and learning results: A2, A3, A5, B5, B9, C19, C22, C25, C27, C28, C32, D5, D6, D7, D11.

Expected results in the subject being evaluated: LO1, LO2, LO3, LO4, LO5, LO6.

EVALUATION CRITERIA FOR EXTRAORDINARY CALL AND FINAL DEGREE

The continuous and global evaluation systems described above will be used.

RECORD QUALIFICATION PROCESS

Regardless of the evaluation system and the call, the average mark, the minimum score to pass the subject is 5. On the other hand, if the minimum score is not exceeded in any part of the evaluation, but the overall score is greater than 4 (out of 10), the grade in the minutes will be 4.

EVALUATION DATES

The dates of the tests corresponding to the continuous assessment system will be published in the calendar of activities, available on the ESEI website https://esei.uvigo.es/docencia/horarios/.

The official exam dates of the different calls, officially approved by the Xunta de Centro of the ESEI, are published on the ESEI website https://esei.uvigo.es/docencia/horarios/.

USE OF MOBILE DEVICES

All students are reminded of the prohibition of the use of mobile devices in exercises and practices, in compliance with article 13.2.d) of the University Student Statute, regarding the duties of university students, which establishes the duty to "Refrain from using or cooperating in fraudulent procedures in the assessment activities, in the delivered assignments or in official documents of the university."

TUTORING SCHEDULE AND PERSONAL TUTORING REQUEST

The tutoring schedule, and the way to request a personal tutoring, is published in the personal page of the teaching staff,

accessible through https://esei.uvigo.es/docencia/profesorado/.

Sources of information

Basic Bibliography

Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, **Design Patterns: Elements of Reusable Object-Oriented Software**, 978-0201633610, 1, Addison-Wesley, 1995

Elisabeth Freeman (Author), Eric Freeman, Bert Bates, Kathy Sierra, Elisabeth Robson, **Head First Design Patterns**, 978-0596007126, 1, O'Reilly, 2004

Robert C. Martin, **Clean Architecture: A Craftsman's Guide to Software Structure and Design: A Craftsman's Guide to Software Structure and Design**, 978-0134494166, 1, Addison-Wesley, 2017

OODesign.com. Object Oriented Design,

Antonio Goncanves, **Beginning Java EE 7**, 978-1430246268, 1, Apress, 2013

Craig Walls, **Spring in Action**, 978-1617294945, 5, Manning, 2018

Complementary Bibliography

GoPivotal, Inc., **Spring Framework**,

Recommendations