270101 - DSI - Information Systems Design

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 747 - ESSI - Department of Service and Information System Engineering
Academic year: 2018
Degree: BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 6

Teaching languages: Catalan

Teaching staff

Coordinator: - Enric Mayol Sarroca (mayol@essi.upc.edu)

Prior skills

Those obtained in subjects pre-required to this subject

Requirements

- Prerequisite IES

Degree competences to which the subject contributes

Specific:

CSI2.2. To conceive, deploy, organize and manage computer systems and services, in business or institutional contexts, to improve the business processes; to take responsibility and lead the start-up and the continuous improvement; to evaluate its economic and social impact.
CSI3.3. To evaluate technological offers for the development of information and management systems.

CSI4.2. To participate actively in the design, implementation and maintenance of the information and communication systems.
CSI4.3. To administrate databases (CES1.6).

CT2.2. To demonstrate knowledge and capacity to apply the characteristics, functionalities and structure of data bases, allowing an adequate use, design, analysis and implementation of applications based on them.
CT2.3. To design, develop, select and evaluate computer applications, systems and services and, at the same time, ensure its reliability, security and quality in function of ethical principles and the current legislation and normative.

Generical:

G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.
Teaching methodology

So that methodology has the expected effects, it is required that students must have been present at least 70% of class hours.

The course is divided into different types of sessions.

There is a session of two hours where the teacher (or some students) present the main concepts of the topic planned for that week with an exhibition and participatory class with other students.

The exercise sessions are intended to work concepts explained in the presentation sessions solving exercises, discussing exercises solved by students, or discussing texts studied by students independently.

The study of individual texts are complemented by the completion of a questionnaire that the teacher can pick up (at the beginning of class) to be assessed and must be used to guide the discussion that takes place in the session problems.

Solved exercises prior to the meeting can be picked up by the teacher (beginning of class) to be evaluated. During the session a student proposes a problem or exercise solution to be discussed between students and teacher.

Sometimes, the teacher proposes an exercise questionnaire to be resolved during this session in small groups, the teacher can gather it to be evaluated and will be discussed at the end of the session.

The hours of independent study are designed to study individually, the conduct of exercises, reading texts and activities proposed by the teacher for the deepening of the theme of the course by the student.

Complementary is planned to carry out two types of work by students:
- Making a Case Study Course, consisting on the design of a small and simple Use Case or a subset of Use Cases for a more complete IS. This design is made using a layered architecture and is the result of applying the concepts studied during the first part of the course. Alternatively, based on the same or another case study, the teacher propose an exercise base on selection of a subsystem or component software standard. These exercises are conducted in groups of 2/3 students.
- Small jobs on searching information related to the theme of the course. This work consists of given some specifications by the teacher of a subject not treated in sufficient detail in class, students must carry out a search of the most significant bibliography and synthesis of the subject. This work is done individually or in groups of 2/3 students and preparing a document structure and content previously agreed with the teacher. In general, these papers will be presented in class for discussion in public among all the other students.

Learning objectives of the subject

1. Understand and know how to choose between different alternatives for the construction and implementation of an IS to the organization.
2. Explain what is an IS development methodology and explain the differences between different specific methodologies.
3. Define what IS design is and the principles that guide this process.
4. Defining the concept of architecture YES, explain some of the most important architectural patterns and their characteristics.
5. Learn to design a simple IF based on a layered architecture.
6. To perform the logical design of databases for an IS from the conceptual framework and management patterns using persistence.
7. Learn to describe the main responsibilities of a database administrator
8. Know how to describe what the integration of components and / or applications and topologies and levels of integration.
9. Learn what it is the acquisition of standard packages, the selection criteria and techniques of adaptation, extension and parameterization.
10. Knowing what is outsourcing the development of an SI, existing strategies, make decisions, as well as advantages and disadvantages.
11. Being aware of the need for a continued and updated knowledge of new types of IF required by the market, new
technologies available and new design methodologies.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Theory classes:</th>
<th>30h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical classes:</td>
<td>30h</td>
<td>20.00%</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>0h</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td>Guided activities:</td>
<td>6h</td>
<td>4.00%</td>
<td></td>
</tr>
<tr>
<td>Self study:</td>
<td>84h</td>
<td>56.00%</td>
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</tbody>
</table>
# 270101 - DSI - Information Systems Design

## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Degree competences to which the content contributes:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction to the Design of Information Systems</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ways to get an IS</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Development Methodologies</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IS Architecture</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IS Design based on a layered architecture</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Application Integration</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Introduction to the Design of Information Systems

*Description:* We introduce the concepts of Information System, Information Technology, and what is the IS design activity.

### Ways to get an IS

*Description:* We discuss and comment alternative ways to incorporate an information system to the organization: custom development, outsourcing development, acquisition standard packages, hiring external services, ...

### Development Methodologies

*Description:* We introduce the concept of software development methodology. We analyze two examples of methodologies. We present the principles that guide the design process.

### IS Architecture

*Description:* We present the concepts of enterprise architecture and architecture of a IS. We study the most important architectural patterns. We present the characteristics of the IS architecture.

### IS Design based on a layered architecture

*Description:* We present in detail the layered architecture. The responsibilities of a use case are distributed between architecture layers (Boundary, Control Entity). We perform the design of the Presentation, Domain and Data Management. We make the logical design of the database schema taking into account the conceptual schema. We study two patterns for managing data persistence. We describe the main responsibilities of a Database Administrator.

### Application Integration

*Description:*
Description:
We describe in what the integration of applications consists. We describe different levels of integration and integration topologies.

Adoption of standard software

Degree competences to which the content contributes:
Description:
We describe the general process for the acquisition and selection of standard software. We describe the selection criteria. We present techniques for adaptation and extension of the functionality of standardized software.

 Outsourcing software development

Degree competences to which the content contributes:
Description:
We introduce the concepts of outsourcing and offshoring. We study the strategies to follow and the decisions to make. We analyse candidate projects to outsource their development. The advantages and disadvantages are analysed.

Advances in design of IS

Degree competences to which the content contributes:
Description:
Briefly analyzed the new advances at methodological level, the new types of IS and new technologies that may affect the activity of IS design.
## Planning of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
<th>Description</th>
<th>Specific objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction to basic concepts of Information Systems and Design of Information Systems</strong></td>
<td>3h</td>
<td>The teacher and students in a collaborative and participatory session analyse the meaning of the concept of Information Systems and of the activity of Design within the life cycle of an information system. Examples are presented and analyzed their characteristics.</td>
<td>3, 12</td>
</tr>
<tr>
<td><strong>Study of alternatives to obtain an IS for the organization</strong></td>
<td>8h</td>
<td>The student will participate in the discussion of the different alternatives presented by teacher for building an IS and will complement it with the study of additional texts.</td>
<td>1, 12</td>
</tr>
<tr>
<td><strong>Study of development methodologies</strong></td>
<td>10h</td>
<td>The student studies in some detail the main features of the two development methodologies and the differences between them. The findings of this study will be presented to the rest of students in a discussion session to compare and analyze the two methods.</td>
<td>2, 3, 12</td>
</tr>
</tbody>
</table>
Study of different IS architectures

**Hours**: 10h  
Theory classes: 2h  
Practical classes: 2h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 6h

**Description**:  
The student complements architecture descriptions given by the teacher with a study based on literature and other documentation provided or find by the student. Students are responsible for the study of one specific architecture in detail and individually. In the session of problems, a student presents his study to discuss among the rest of the class.  
**Specific objectives**: 4, 12

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Study the process of adopting standard software

**Hours**: 3h  
Theory classes: 1h  
Practical classes: 0h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 2h

**Description**:  
Students will perform a deepening of these themes with the reading of supplementary texts.  
**Specific objectives**: 9, 12

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Selection techniques and extension of standard software.

**Hours**: 20h  
Theory classes: 4h  
Practical classes: 4h  
Laboratory classes: 0h  
Guided activities: 0h  
Self study: 12h

**Description**:  
The students carry out tasks and problems posed by the teacher for the selection of a particular standard package, both in defining the criteria to consider, as in the evaluation process and selection. At the same time, we propose the deepening technical extension of the functionality of a standard package with the use of a pattern while performing an exercise and its application in Case Study course.  
**Specific objectives**: 9, 12
Study of a Layedred Architecture

**Hours**: 10h
- Theory classes: 2h
- Practical classes: 2h
- Laboratory classes: 0h
- Guided activities: 0h
- Self study: 6h

**Description:**
Students will participate in the analysis of different examples of IS and its relationship in a layered architecture.

**Specific objectives:**
4, 12

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Delivery of the selection of a standard software package made to the Case Study of the Course.

**Hours**: 3h
- Theory classes: 0h
- Practical classes: 0h
- Laboratory classes: 0h
- Guided activities: 3h
- Self study: 0h

**Description:**
Students will give the teacher the result of the selection process of a standard software package for Case Study Course. The delivery will be in two parts: the first of the criteria selected to perform it and the second consists in the selection process and outcome evaluation.

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Delivery of the exercise of software package selection of the Case Study of the course.

**Hours**: 1h
- Guided activities: 0h
- Self study: 1h

**Description:**
Students will give the teacher the results of the process of Selecting a Software Package for the Case Study of the course. The delivery will be in two parts: the first part is the description of the selection criteria chosen by the package, and the second part will consist of the outcome of the selection process and evaluation.

**Specific objectives:**
9

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Allocation of Responsibilities to Layers and Use Case Realization

**Hours**: 10h
- Theory classes: 2h
- Practical classes: 2h
- Laboratory classes: 0h
- Guided activities: 0h
- Self study: 6h

**Description:**
The student will document the Use Case Realization of an IS by means of problems proposed to discuss into the class of problems. At the same time, students apply these concepts in the Case Study of the course.
### Design of the Presentation Layer

**Description:**
Students will study in depth the Model-View-Controller pattern and perform exercises applying it. In turn, the student will carry the design of the presentation layer of the proposed Case Study of the course using the artifacts and documentation proposed and applying the Model-View-Controller pattern.

**Specific objectives:**
5

<table>
<thead>
<tr>
<th>Hours</th>
<th>Theory classes</th>
<th>Practical classes</th>
<th>Laboratory classes</th>
<th>Guided activities</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>17h</td>
<td>2h</td>
<td>4h</td>
<td>0h</td>
<td>0h</td>
<td>11h</td>
</tr>
</tbody>
</table>

### Design of the Domain Layer

**Description:**
Students will participate in the recall and depth of these decisions.

**Specific objectives:**
5

<table>
<thead>
<tr>
<th>Hours</th>
<th>Theory classes</th>
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<th>Laboratory classes</th>
<th>Guided activities</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>2h</td>
<td>1h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>1h</td>
</tr>
</tbody>
</table>

### Design of the Persistence Layer

**Description:**
Students practice with exercises and problems suggested by the teacher making the design of a database. In addition, students will analyze the performance of exercises and problems, the implications in the design of information system applied a strategy of persistence or another. Moreover, the students will design the persistence layer of management in the Case Study of the course to be undertaken.

**Specific objectives:**
5, 6, 12

<table>
<thead>
<tr>
<th>Hours</th>
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<th>Guided activities</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>20h</td>
<td>4h</td>
<td>4h</td>
<td>0h</td>
<td>0h</td>
<td>12h</td>
</tr>
</tbody>
</table>
### Responsibilities of the Database Manager of the organization

**Description:**
Students will analyze and discuss with the teacher the responsibilities of a Database Administrator for an organization and its participation in the activity of designing an IS.

**Specific objectives:**
- 7

<table>
<thead>
<tr>
<th>Hours</th>
<th>Theory classes: 1h</th>
<th>Practical classes: 0h</th>
<th>Laboratory classes: 0h</th>
<th>Guided activities: 0h</th>
<th>Self study: 2h</th>
</tr>
</thead>
</table>

### Introduction to Application Integration

**Description:**
Students will perform a deepening of the theme from reading additional texts to be discussed at the meetings of problems.

**Specific objectives:**
- 8, 12

<table>
<thead>
<tr>
<th>Hours</th>
<th>Theory classes: 2h</th>
<th>Practical classes: 2h</th>
<th>Laboratory classes: 0h</th>
<th>Guided activities: 0h</th>
<th>Self study: 4h</th>
</tr>
</thead>
</table>

### Delivery of the design of layers of the Case Study of the course.

**Description:**
Students will give the teacher design a small SI (or part of an IF) using a layered architecture. The delivery will be in two parts: first the general approach of working to arrange a date between the group of students and teachers, and the second will consist of complete design once completed.

**Specific objectives:**
- 4, 5, 6, 12

<table>
<thead>
<tr>
<th>Hours</th>
<th>Theory classes: 0h</th>
<th>Practical classes: 0h</th>
<th>Laboratory classes: 0h</th>
<th>Guided activities: 3h</th>
<th>Self study: 0h</th>
</tr>
</thead>
</table>

### Delivery of the Case Study Design based on a layered architecture.

**Hours:** 1h
- Guided activities: 0h
- Self study: 1h
### Description:

Students give to the teacher the design of a small IS (or part of a IS) following a layered architecture. The delivery will be in two parts: first part consists on the plan a general structure of the design in a date arranged between the group of students and the teacher, and the second part will consist of the complete design.

### Specific objectives:

4, 5, 6, 12

### Study on the outsourcing software development process

<table>
<thead>
<tr>
<th>Hours</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 2h</td>
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<tr>
<td></td>
<td>Laboratory classes: 0h</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h</td>
</tr>
</tbody>
</table>

### Description:

Students will perform a deep study of the theme by reading of supplementary texts.

### Specific objectives:

10, 12

### New trends and future

<table>
<thead>
<tr>
<th>Hours</th>
<th>Theory classes: 0h</th>
</tr>
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<tbody>
<tr>
<td></td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h</td>
</tr>
</tbody>
</table>

### Description:

The student (and teacher), through the literature search and documentation, provide examples of new developments in the design of new types of IS in organizations that are appearing, new trends and new methodological IS architectures.

### Specific objectives:

1, 2, 3, 4, 8, 9, 10, 12

### End of course questionary

<table>
<thead>
<tr>
<th>Hours</th>
<th>Guided activities: 1h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self study: 0h</td>
</tr>
</tbody>
</table>

### Description:

It is a questionnaire about the whole subject of course to assess the level of student learning.
Final Score (NF) of the technical skills of the subject is obtained by weighting the rating questionnaires and exercises (NQE), Note Case Study course (NCE), the Research Working Note Information (NTR) and Participation Note (NP):

\[ NF = 0.35 \times NQE + 0.25 \times NCE + 0.30 \times NTR + 0.10 \times NP \]

where:

The NQE is the average of the notes of the exercises and quizzes that teachers gather for the kinds of problems. The final questionnaire of course has a weight of 30% within this component. The rest of questionnaires have a weight of 70% within this component. It is required that the student has delivered 80% of the collected works. The final course questionnaire, which is required resolution for all students. Failure to deliver more than 80% of questionnaires / exercise, or not deliver the final questionnaire, this component will be evaluated with NQE = 0.0.

Failure to attend class or work session before the proposed questionnaire, forbids to deliver solved questionnaire.

The NCE is the note concerning the completion of the exercise of Design in layers and / or Standard Software Selection made by the students for the Case Study proposed for the course. Students, with teacher recommendation and taking into account their previous knowledge, made under compulsion of the two exercises. These works are done in small groups of 2-3 students and deliveries will be made with an interview with the teacher to present and explain the work. The note for each student is calculated from record obtained from the work.

The NTR is the note of the work of searching for information given during the course. These works consist of the student search for information to different topics studied in class. According to the topic of study, it is proposed to be made individually or in groups. The note of each student is calculated from record obtained from the work and is proportional to the dedication of each student in the performance of work, the quality of the information and searched, and their capacity for synthesis of their findings.

There is no predetermined number of research information to be requested during the course the student. In all the activities proposed for the student to do a search for information or further learning, or on their own initiative of the student, students prepare a report. This report will contain a list of information sought by the student from references provided by the teacher or references you need the student, with a brief summary of their contents and an analysis of the contribution that has this information regarding the working in class.

Failure to attend the session of research presentations (if any) prevents the opportunity to submit their own work or to solve session questionnaire.

The NP is the assessment by the teacher of the student's participation in the meetings at which the teacher or other students present the concepts of the subject and especially in the discussion sessions of problems. Additionally also takes into account the student's participation in the work of finding information.

The attendance of less than 70% of classes involve an assessment of 0.0 in this section.

The assessment of competence assigned to cross the course is obtained from the evaluation of delivery (NTR) and taking into account participation (NP), and has values A, B, C, D, as:

- o if the note is between 8.5 and 10
- or B if the note is between 7 and 8.4
- or C if the score is between 5 and 6.9
- or D if the note is less than 5
Bibliography

Basic:


Complementary:


Others resources:

Hyperlink