UNIVERSIDAD POLITÉCNICA DE MADRID
FACULTAD DE INFORMÁTICA
Campus de Montegancedo
Boadilla del Monte. 28660 Madrid

Experimental Software Engineering

Learning Guide – Information for Students

1. Description

Grade	European Master in Software Engineering
Module	N/A
Area	Advanced Software Engineering Aspects
Subject	Experimental Software Engineering
Type	Elective
ECTS credits	6
Responsible department	Software Engineering
Major/Section/	N/A

Academic year	2012/2013
Term	2nd term
Language	English
Web site	http://www.grise.upm.es/UPM_subjects.php?name=ESE

2. Faculty

NAME and SURNAME	OFFICE	email
Natalia Juristo (Coord.)	D-5104	natalia@fi.upm.es
Sira Vegas	D-5105	sira@fi.upm.es

3. Prior knowledge required to take the subject

Passed subjects	N/A
Other required learning outcomes	N/A

4. Learning goals

SUBJECT-SPECIFIC COMPETENCES AND PROFICIENCY LEVEL		
Code	**Competence**	**Level**
CE13	To have a vision of the different specific and emergent aspects of the Software Engineering, and to go further in some of them.	A
CE14	To understand what nowadays software engineering procedures can and cannot reach, their limitations and their possible future evolution.	C

Proficiency level: knowledge (K), comprehension (C), application (A), and analysis and synthesis (S)

SUBJECT LEARNING OUTCOMES			
Code	**Learning outcome**	**Related competences**	**Proficiency level**
LR1	Given a particular software engineering field, the student will be able to design and evaluate the most adequate approach to solve some of the related problems, highlighting the technical difficulties and limits of application.	CE13, C14	A

Proficiency level: knowledge (K), comprehension (C), application (A), and analysis and synthesis (S)

5. Subject assessment system

ACHIEVEMENT INDICATORS		
Ref	**Indicator**	**Related to LR**
I1	Understand the limitation of nowadays software engineering technologies due to the lack of a scientific study of them	LR1
I2	Understand what an experimental laboratory and an experiment are for software engineering	LR1
I3	Know the different elements of a software engineering experiments: response variable, factors, levels, etc.	LR1
I4	Design experiments for software engineering technologies: randomization, other control strategies, types of designs, etc.	LR1
I5	Understand the report of software engineering experiments	LR1
I6	Apply basic statistical data analysis techniques (i.e.: t-test, ANOVA, sample size calculation)	LR1

CONTINUOUS ASSESSMENT			
Brief description of assessable activities	**Time**	**Place**	**Weight in grade**
• Set up an experiment (operationalize and design it)	5th Weeks	Classroom & moodle	25%
• Run the experiment and collect observations	7th week	Classroom & moodle	25%
• Analyze the data collected	8th week	Classroom & moodle	25%
• Interpret the results including comparisons with the results of the classroom mates experiment versions	9th week	Classroom & moodle	25%
			Total: 100%

GRADING CRITERIA

- Students will be evaluated using the assignments only. No examination will be made.
- The assessment of assignments will depend on (1) presentation made by the students at the classroom and (2) the correctness of the results.
- The final grade will be calculated using a weighted average as described before.

5. Contents and learning activities

SPECIFIC CONTENTS		
Unit / Topic / Chapter	**Section**	**Related indicators**
Chapter 1: Introduction to experimental software engineering	1.1. Basics of experimentalism 1.2. The scientific method 1.3. Scientific Rules: Cause-effect relationships 1.4. Scientific immaturity of software engineering	I1
Chapter 2: Laboratory and experiment	2.1. The concept of laboratory 2.2. The concept of experiment 2.3. A lab for software engineering 2.4. An experiment for software engineering	I2
Chapter 3: Elements of an experiment	3.1. Response variables 3.2. Factors and levels 3.3. Types of empirical studies	I3, I5
Chapter 4: Designing experiments	4.1. Types of variables 4.2. Types of control 4.3. Validity	I4, I5
Chapter 5: Data analysis	5.1. Basics of inferential statistics 5.2. Procedures to compare 2 means: t, Mann-Whitney 5.3. Procedures to compare k means: ANOVA 5.4. Statistical power	I6

6. Brief description of organizational modalities and teaching methods

TEACHING ORGANIZATION		
Scenario	**Organizational Modality**	**Purpose**
	Theory Classes	***Talk to students***
	Seminars/Workshops	***Construct knowledge through student interaction and activity***
	Practical Classes	***Show students what to do***
	Placements	***Round out student training in a professional setting***
	Personal Tutoring	***Give students personalized attention***
	Group Work	***Get students to learn from each other***
	Independent Work	***Develop self-learning ability***

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TEACHING METHODS		
	Method	**Purpose**
	Explanation/Lecture	***Transfer information and activate student cognitive processes***
	Case Studies	***Learning by analyzing real or simulated case studies***
	Exercises and Problem Solving	***Exercise, test and practice prior knowledge***
	Problem-Based Learning (PBL)	***Develop active learning through problem solving***
	Project-Oriented Learning (POL)	***Complete a problem-solving project applying acquired skills and knowledge***
	Cooperative Learning	***Develop active and meaningful learning through cooperation***
	Learning Contract	***Develop independent learning***

Known as explanation, this teaching method involves the "*presentation of a logically structured topic with the aim of providing information organized according to criteria suited for the purpose".* This methodology, also known as *lecture*, mainly focuses on the verbal exposition by the teacher of contents on the subject under study. The term *master class* is often used to refer to a special type of lecture taught by a professor on special occasions

Intensive and exhaustive analysis of a real fact, problem or event for the purpose of understanding, interpreting or solving the problem, generating hypotheses, comparing data, thinking, learning or diagnosis and, sometimes, training in possible alternative problem-solving procedures.

Situations where students are asked to develop the suitable or correct solutions by exercising routines, applying formulae or running algorithms, applying information processing procedures and interpreting the results. It is often used to supplement lectures.

Teaching and learning method whose starting point is a problem, designed by the teacher, that the student has to solve to develop a number of previously defined competences.

Teaching and learning method where have a set time to develop a project to solve a problem or perform a task by planning, designing and completing a series of activities. The whole thing is based on developing and applying what they have learned and making effective use of resources.

Interactive approach to the organization of classroom work where students are responsible for their own and their peers' learning as part of a co-responsibility strategy for achieving group goals and incentives.

This is both one of a number of methods for use and an overall teaching approach, or philosophy.

An agreement between the teacher and student on the achievement of learning outcomes through an independent work proposal, supervised by the teacher, and to be accomplished within a set period. The essential points of a learning contract are that it is a written agreement, stating required work and reward, requiring personal involvement and having a time frame for accomplishment.

BRIEF DESCRIPTION OF THE ORGANIZATIONAL MODALITIES AND TEACHING METHODS	
THEORY CLASSES	Every chapter/part of the course begins with a 1-2 hours of theory classes
PROBLEM-SOLVING CLASSES	Exercised are sandwiched in the theory classes. Every chapter/part of the course counts on 1-2 hours of exercised solved by the professor through discussion with the students
PRACTICAL WORK	Every chapter/part of the course counts with a practical work performed by the students.
INDIVIDUAL WORK	The practical work is performed partly individually partly in a group
GROUP WORK	The practical work is performed partly individually partly in a group
PERSONAL TUTORING	Students can access professors for tutoring constantly by e-mail and moodle.

7. Teaching resources

TEACHING RESOURCES	
RECOMMENDED READING	Natalia Juristo, Ana Moreno; Basics of software engineering experimentation. Kluwer 2001.
	Claes Wohlin et al.; Experimentation in software engineering: An introduction. Kluwer 2000.
WEB RESOURCES	Subject web site http://www.grise.upm.es/UPM_subjects.php?name=ESE
	Subject Moodle site http://moodle.upm.es/titulaciones/oficiales/course/view.php?id=1575
EQUIPMENT	Laboratory: TBD
	Room: TBD
	Group work room: TBD

8. Subject schedule

Week	Classroom activities	Lab activities	Individual work	Group work	Assessment activities	Others
1 (8 hours)	• Lecture: Chapter 1 (4 hours)	-	• Individual study (4 hours)	•	-	-
2 (4 hours)	• Lecture: Chapter 2(1 hour) • Problem-solving activity: Chapter 2 (1 hours)	•	• Individual study (2 hours)	•	-	-
3 (8 hours)	• Lecture: Chapter 3 (1 hours) • Problem-solving activity: Chapter 3 (1 hour) • Lecture: Chapter 5 (2 hours)		• Individual study (4 hours)	•		
4 (8 hours)	• Lecture: Chapter 4 (2 hours) • Problem-solving activity: Chapter 4 (2 hour)	•	• Individual study (4 hours)			
5 (20 hours)	• Lecture: Chapter 5 (2 hours)	-	• Assignment 1: Set up an experiment (9 hours)	• Assignment 1: Set up an experiment (9 hours)	•	

6 (16 hours)	• Lecture: Chapter 5 (2 hours)	Brainstorming and group discussion at classroom about the set ups (2 hours)	• Assignment 1: Set up an experiment (6 hours)	• Assignment 1: Set up an experiment (6 hours)	•	-
7 (30 hours)	-	• -	Assignment 2: Run the experiment (15 hours)	Assignment 2: Run the experiment (15 hours)	•	-
8 (14 hours)	• Lecture: Chapter 5 (2 hours) • Problem-solving activity: Chapter 5 (2 hours)		• Assignment 3: Analyze collected data (5 hours)	Assignment 3: Analyze collected data (5 hours)	-	-
9 (14 hours)	-	• -	• Preparation of presentation (5 hours)	• Preparation of presentation (5 hours)	• Presentation of assignments 1-3 (4 hours)	-
10 (14 hours)		Brainstorming and group discussion at classroom about assignment 4 (4 hours)	Assignment 4: Interpreting results (5 hours)	Assignment 4: Interpreting results (5 hours)	•	

11 (14 hours)		Brainstorming and group discussion at classroom about assignment 4 (4 hours)	Assignment 4: Interpreting results (5 hours)	Assignment 4: Interpreting results (5 hours)	•	
12 (12 hours)		•	• Preparation of presentation (4 hours)	• Preparation of presentation (4 hours)	• Presentation of assignment 4 (4 hours)	

Note: Student workload specified for each activity in hours