Centre	**University College of Engineering of Vitoria-Gasteiz**
Name of subject	**26022 – Introduction to Operating Systems**
Qualification	**Degree in Computer Management and Information Systems Engineering**
Type	**Compulsory**
Credits	**6 ECTS**
Year	**2**
Term(s)	**2nd**
Department	**Computer Languages and Systems**
Language	**Spanish**

Outcomes / Objectives

Description of the operating system as an interface to applications and as a computer resource manager, with emphasis on its use in different types of systems (time-sharing, real time, etc.), its key concepts (files, access protection, processes, communication elements), and the functionality of its components (subsystems for process management, memory, input/output).

Syllabus

Introduction
Definition of operating system as an interface to applications and as a computer resource manager.
History of operating systems.
Types of systems according to their functionality (single-programming, multiprogramming, time-sharing, real-time, embedded and distributed).
Operating system interfaces (user, administration, application, developer).
Current operating system market (proprietary systems, open systems, free software) and prospects. Practice: the shell as a user and administration interface.

System call mechanism
Taking as support the elements provided by the hardware interface (address spaces, device interface, interrupt mechanism), determine the basic common services to be established as resident code.
Concept of operating system call as an access function to a resident service.
Implementation of system calls through the interrupt mechanism and execution modes.

Practice: specify in C examples of service access routines.
Input/output and files

Concept of device independence and input/output redirection.
System calls related to input/output.
Operating modes on specific devices and on files.
Concept of file system and its representation mechanisms.
Practice: use shell redirections, handle the file system from the shell, program examples of input/output.

User management and security
Definition of multiuser system.
Types of users, access modes and protection domains.
Basic mechanisms for access protection management in centralised systems.

System calls related to access protection and security.
Practice: use of access rights from the shell.

Memory management
Program loading and location in systems with one or several programs in memory.
Physical and virtual addressing.
Static and dynamic relocation.
Re-entrant code.
Support for virtual memory systems.
Dynamic link libraries.
Operating system calls related to program loading and memory management. Practice: programming of a simple launcher, monitoring memory usage (with re-entrant programs).

Process control
Concept of flow and execution context.
Multiprogramming systems and multi-threaded systems.
Concept of process (Unix model), states and transition graph.
Change of context.
Process planning and basic planning policy.
Operating system calls related to process control.
Practice: launching background processes from the shell and process monitoring, modifying the launcher to make it multi-program.

Communication and synchronisation between processes
Concepts of concurrency, shared resource, race condition, and exclusive access.
Critical code sections.
Basic mechanisms for exclusive access to critical sections.
Communication with message passing through mailboxes.
System calls related to communication between processes.
Client-server based resource management model.
Examples of resource managers (drivers).
Practice: communication between processes (through pipes) from the shell, simple example of manager.

Methodology

Teaching Method

Face-to-Face Teaching Hours								
Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
40			20					
Student Hours of Non Face-To-Face Activities								
Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
50			40					

Assessment System

General criteria

Written essay exam

Practical activities (exercises, case studies or problems)

Clarification regarding assessment

Previous years' documentation:

Written exam samples at http://lsi.vc.ehu.es/pablogn/docencia/ficheros/ISO%20ex/

Theory presentations: http://lsi.vc.ehu.es/pablogn/docencia/ficheros/ISO0910/

Bibliography

Basic Bibliography

- C. Rodríguez, I. Alegria, J. González, A. Lafuente: Descripción Funcional de los Sistemas Operativos. Síntesis, 1994.
- F.M. Márquez: UNIX. Programación Avanzada 3rd Edition. Rama, 2004.
- Afzal: Introducción a UNIX. Un enfoque práctico. Prentice-Hall, 1997.
- B.W. Kernighan, R. Pike: The Unix Programming Environment, Prentice-Hall, 1984.
- A.S. Tanenbaum: Modern Operating Systems (3rd Edition), Prentice-Hall, 2008.

In-depth Bibliography

- M. Rochkind: Advanced Unix Programming, Addison-Wesley, 2004.
- Silberschatz, P.B. Galvin, G. Gagne: Operating System Concepts (Eighth edition), John Wiley & Sons, 2008.
- W. Stallings: Sistemas Operativos (Fifth edition). Prentice-Hall, 2005.

Websites

- Subject website
- www.linux.org
- www.gnu.org