

MODULE DESCRIPTOR

MODULE TITLE	Fault Tolerant Systems		
MODULE CODE	EL3997 (L6)	CREDIT VALUE	20 UK CREDITS / <u>10 ECTS</u>
SCHOOL	SCHOOL OF SCIENCES		

MODULE AIMS

The aims of the module are

- Provide an introduction to fault tolerant systems mainly from the hardware point of view
- To provide knowledge about how to achieve fault tolerance by using redundancy

MODULE CONTENT

Indicative syllabus content:

Introduction

- oOverview and motivation, basic principles and fundamental concepts
- oDependability concepts: dependable system, techniques for achieving dependability, dependability measures,
- oFundamental definitions: faults, errors, failures, fault/error models
- oFault models and error manifestations, permanent vs. transient faults
- oFault tolerant strategies and design techniques: Fault detection, masking, containment, location, reconfiguration, and recovery, Techniques (Hardware redundancy, software redundancy, time redundancy, and information redundancy).
- oReliability and availability analysis

Hardware Redundancy

- oPassive/active hardware redundancy
- oModular redundancy, voting techniques
- oFault tolerance at processor level; Byzantine General problem, consensus protocols, checkpointing and recovery

Information Redundancy

- oCoding
- oResilient disk systems (RAID)
- oAlgorithm-Based Fault Tolerance (ABFT)

Other Topics

- oFailures in error-correcting mechanisms, circuits of “noisy” gates
- oFault tolerant networks; measures of network resilience/reliability
- oSoftware fault tolerance
- oFault-tolerant dynamic systems (non-concurrent error detection and identification)
- oDistributed function calculation/consensus, tolerance to faulty/malicious agents

INTENDED LEARNING OUTCOMES

On successful completion of this module a student will be able to:

1. Explain the risk of computer failures and their peculiarities compared with other equipment failures
2. Evaluate the importance of fault tolerance in computer engineering
3. Compare the various redundancy techniques to achieve fault tolerance
4. Critically evaluate the trends and emerging technologies in fault tolerant systems

TEACHING METHODS

The module examines a useful range of the fundamental aspects of fault tolerant systems. Lectures will be delivered on campus to provide the formal taught content including concepts, techniques and information. Lectures present the principles and techniques for designing fault-tolerant digital

systems, including combinational logic, dynamic systems, and networks. The practical/tutorial sessions supplement and support the lectures allowing a discovery approach to learning. As part of these practical sessions students will practice with various exercises and use cases.

Web Links that contain relevant research material will be provided to the students in support of the syllabus. Students will prepare and share summaries of technologies and system components. Students will discuss case studies and explore implications

The assessment is designed to assess both the students' comprehension of theoretical topics relevant to Fault Tolerant Systems (exam) and their research skills in evaluating the modern trends in this topic (coursework).

ASSESSMENT METHODS

This module is assessed through an exam and an assignment.