

## **750781, Formal Methods in Software Engineering**

3 hours per week, 3 credit hours, prerequisite: **none**

**Teaching Method:** 37 hours Lectures (2-3 hours per week) + 8 hours Seminars (1 per 2 weeks)

**Aims:** This module is to introduce basic concepts of formal methods and their practical applications in software engineering. Students will learn why and how formal methods should be used in the entire software development process for delivering a product of quality assurance. The following topics will be discussed:

formal methods based software life-cycle models; languages for software system specification; modeling and abstraction of software systems; Software architectures, analysis and verification of system properties; system refinement and program transformation; formal semantics, program specification and verification.

### **Learning Outcomes:**

On completion of this module, the student should:

- Understand the concepts of formal methods and their usage in software engineering.
- Have knowledge on languages for software system specifications.
- Be able to use the formal methods in software development process.

### **Textbooks and Supporting Materials:**

#### **I. Textbooks:**

1- Formal Methods for Software Architectures: Third International School on Formal Methods for the Design of

Computer, Communication and Software Systems: Software Architectures, SFM 2003, Bertinoro, Italy,

September 22-27, 2003, Advanced Lectures.

2- J. B. Wordsworth, Software Development with Z, Addison Wesley,

3- Michael G. Hinchey & Jonathan P. Bowen, Applications of Formal Methods, Prentice Hall, 1995.

4- Matt Kaufmann, Panagiotis Manolios, and J Strother Moore, Computer-Aided Reasoning: An Approach, Kluwer Academic Publishers, June, 2000. (ISBN: 0-7923-7744-3)

5- Doron A. Peled, Software Reliability Methods. Springer-Verlag, 2001.

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6- Johann M. Schumann Automated Theorem Proving in Software Engineering, Springer-Verlag, 2001.

## **II. Selected Research papers** (Formal Methods Resources Websites)

## **III. Z software development tools**

### **Synopsis:**

1- Introduction: What are Formal methods? ; Why Formal methods? ; Formal methods and Software Process.

2- Requirements, Models, Formal Specifications.

3- Formal Analysis and Verification.

4- Software Development in Z and in ObjectZ.

5- Formal Semantics.

6- Refinement and Program Transformation.

7- Program Specification and Verification.

8- Formal methods for Software Architectures.

**Assessment:** Two 1-hour midterm exams (15% each); Assignments (10%); Seminars (10%); 2-hours

Final Exam (50%)