University/Academy: Arab Academy for Science and Technology & Maritime Transport
Faculty/Institute: College of Computing and Information Technology
Program: Software Engineering

Form No. (12)
Course Specification

1- Course Data

Course Code: SE494	**Course Title:** **Formal Methods in Software Engineering**	**Academic Year/Level:** Year 4 / Semester 7
Specialization: Software Engineering	**No. of Instructional Units:** 2 hrs lecture 2 hrs lab	**Lecture:**

2- Course Aim	This course introduces the use of formal mathematical notation and reasoning in the software development process. These methods have applications in requirements specification, design, and verification. Course topics include mathematical foundations, predicates, preconditions and post conditions, alternative notations, types of formal models, and the strengths and limitations of formal methods.
3- Intended Learning Outcome:	
a- Knowledge and Understanding	**Students will be able to demonstrate knowledge of:** K12.Understanding essential facts, concepts, principles and theories relevant to software engineering. K15.Demonstrate strong knowledge of software systems analysis & design, data and Information Management, software project management, and software development models. K20.Modeling organizational processes and data, defining and implementing technical and process solutions, managing projects, and integrating software systems What are formal methods? When are they useful? How can we use formal methods? • The pros and cons of using formal method • Work in stages, gathering Requirements, and validating formal specifications. • Introduce the z methos in formal methods • Informal requirements, data flow diagram • State transition diagram ans state transition table • Basic types and abbreviation definitions, Axiomatic descriptions,

	state schemas and operation schemas • Sets and types, declarations, and variables. • Expressions and operators • Predicates, equations, and laws • Tuples and records, Relations, tables and databases, pairs and binary relations • Basic predicates, relations as predicates, Logical connectives • Using schema types and binding • Calculation and proof, laws, checking specifications, and Precondition calculation • Subsystems, conditions, and modes.
b- Intellectual Skills	**By the end of the course, the student acquires high skills and an ability to understand:** I10.Identify and define traditional and nontraditional software systems problems, set goals towards solving them, and observe results. I12.Perform comparisons between (methods, techniques, strategies ...etc). I15. Identify a range of solutions and critically evaluate and justify proposed design solutions.

c- Professional Skills	**By the end of the course the student will have the ability to:** P10. Use quantitative analysis techniques appropriately and effectively P13. Communicate effectively by oral, written and visual means, produce acceptable reports and technical and user system documentation. P17.Evaluate systems in terms of general quality attributes and possible tradeoffs presented within the given problem. P18.Maintaining existing software systems
d- General Skills	**Students will be able to:** G1. Demonstrate the ability to make use of a range of learning resources and to manage one's own learning. G2. Demonstrate skills in group working, team management, time management and organizational skills. G3. Show the use of information-retrieval.

4- Course Content

1	Understand the mathematical basis of formal methods.
2	Understand the risks of poorly specified software systems
3	Use formal specification languages in requirement specifications.
4	Apply formal reasoning and proof techniques in software verification and validation.
5	Understand the role of formal methods in software engineering practice.
6	Model software systems using formal methods.
7	Communicate software requirements and designs using a formal notation.

5- Teaching and Learning Methods	Lectures, Labs, Projects
6- Teaching and Learning Methods for Students with Special Needs	• Students with special needs are requested to contact the college representative for special needs (currently Dr Hoda Mamdouh in room C504) • Consulting with lecturer during office hours. • Consulting with teaching assistant during office hours. • Private Sessions for redelivering the lecture contents. For handicapped accessibility, please refer to program specification.

7- Student Assessment:

a- Procedures used:	Exams and Projects
b- Schedule:	Week 7 exam 1 Project Week 16Final exam
c- Weighing of Assessment:	7th week exam 30% Project 20% Lab work 10% Final exam 40%

8- List of References:

a- Course Notes	
b- Required Books (Textbooks)	Jonathan Jacky, *The Way of Z: Practical Programming with Formal Methods*, Cambridge University Press, 1997.
c- Recommended Books	1. Ian Sommerville, *Software Engineering*, 9th Edition, Pearson Education, 2010. 2. A. Diller, *Z: An Introduction to Formal Methods*, 2nd Edition, Wiley, 1994.

d- Periodicals, Web Sites, ..., etc.	

Course Instructor: **Head of Department:**

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