



University of Tehran
School of Electrical and Computer Engineering

Course	Dependable Software Systems		
Course type, level, credit	Optional	Graduate	3 units
Field, Major	Computer Engineering	Software	
Co-requisite(s)	-		
Prerequisite(s)	-		
Prerequisite by topic	Operating Systems concepts, Statistics and Probability, Programming/Data Structure		
Goals	<p>In today's technological world, nearly everyone depends upon the continued functioning of a wide array of complex machinery and equipment for our everyday safety, security, mobility and economic welfare. We expect our electric appliances, hospital monitoring control, next-generation aircraft, data exchange systems, and aerospace applications to function wherever and whenever we need them. When they fail, the results can be catastrophic. As our society grows in complexity, so do the critical challenges in the area of system and software dependability engineering. The greatest problem facing the industry today is how to assess quantitatively system software reliability characteristics.</p> <p>This course consists of two related parts. The first deals with engineering of dependable and fault-tolerant software. The second focuses on the software dependability evaluation. In the first part, the course introduces basic software dependability concepts, relevant models and discusses processes for engineering of dependable software, including schemes and patterns for the design of dependable and fault-tolerant software. In the second part, we discuss various groups of traditional software dependability models and methods for evaluating software reliability and other non-functional properties, such as software complexity and the number of remaining errors.</p>		
Outcome	<p>Upon successful completion of the course, students can:</p> <ul style="list-style-type: none"> • Understand the concepts related to software and system dependability • Understand the requirements of design, modeling and analysis of software and system dependability • Analysis methods for dependability criteria • Understand the challenges of software quality improvement 		

	and the way to deal with them.
Topics	<ul style="list-style-type: none"> • Introduction to system software reliability, reliability measures and terminologies • System reliability engineering, systemability, different failure modes • Stochastic processes for reliability modeling (including Markov process, renewal process, non-homogeneous Poisson process ...) • Software vs. hardware reliability • Software reliability and testing concepts • Software reliability modeling (Error seeding, Failure rate, Curve fitting, Reliability growth, Markov structure, Time series, NHPP models) • Imperfect-debugging models • Testing coverage and removal models • Verification and validation techniques • Optimal software release policies • Different redundancy techniques • Fault-tolerant software design techniques • Dynamic software updating • Software rollback and recovery techniques • Networked systems reliability • Fault-tolerant system reliability modeling
Required software	Related to the course projects
Assignments	6 homework and paper review
Projects	Simulation/Tool
Grading	Assignments and Project: 40% Midterm exam: 30 % Final exam: 30 %
Textbook(s)	[1] I. Koren, C.M. Krishna, Fault-Tolerant Systems, Morgan Kaufmann Publishers, Elsevier, 2007. [2] H. Pham, System Software Reliability, Springer-Verlag, 2006. [3] Simona Bernardi, Jose Merseguer, Dorina C Petriu, Model-Driven Dependability Assessment of Software Systems, Springer, 2013. [4] R. Taylor, N. Medvidovic, and M. Dashofy, Software Architecture: Foundations, Theory, and Practice, John Wiley & Sons, 2009. [5] Articles from IEEE & ACM Transactions and Conferences, and Springer and Elsevier Journals.
Further readings	[1] M. L. Shooman, Reliability of Computer Systems and Networks: Fault-Tolerance, Analysis, and Design, John Wiley & Sons, 2002. [2] L. L. Pullum, Software Fault-Tolerance: Techniques and Implementation, Artech Hous, 2001.

