

1	Course title	Reliability Theory
2	Course number	0301934
3	Credit hours (theory, practical)	3
	Contact hours (theory, practical)	3
4	Prerequisites/corequisites	None
5	Program title	Ph.D.
6	Program code	
7	Awarding institution	The University of Jordan
8	School	Science
9	Department	Mathematics
10	Level of course	Specialization requirement
11	Year of study and semester (s)	Second year
12	Final Qualification	Ph.D. degree
13	Other department (s) involved in teaching the course	None
14	Language of Instruction	English
15	Date of production/revision	

#### 16. Course Coordinator:

Dr. Mohammad Z. Raqab  
Department of Mathematics  
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#### 17. Other instructors:

Dr. Hisham Hilow  
Department of Mathematics  
Email: [hilow@ju.edu.jo](mailto:hilow@ju.edu.jo)

#### 18. Course Description:

This course is aimed at providing the students an introduction to some of the most used reliability concepts and theories including reliability systems and related distributions, failure rate functions and nonparametric classes, accelerated life testing, dependent failure analysis, statistical inference of reliability data.

**19. Course aims and outcomes:**

<p>A- Aims: The main aim of this course is to expose students to a variety of techniques that can be used to deal with reliability theory.</p> <p><b>B- Intended Learning Outcomes (ILOs): Upon successful completion of this course students will be able to</b></p> <ol style="list-style-type: none"> <li>1. Explain the role of solid statistical and probability modeling in reliability studies</li> <li>2. Demonstrate understanding of coherent reliability systems with independent or dependent components.</li> <li>3. Analyze failure data based on CFR, IFR, DFR, IFRA and DFRA families</li> <li>4. Determine optimal reliability-based maintenance strategies to fulfill system functions</li> <li>5. Enable the students to model the failure behavior of a multi-unit system</li> <li>6. Account for industrial applications of different methods in reliability theory</li> </ol>
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**20. Topic Outline and Schedule:**

Topic	# of Weeks	Instructor	Achieved ILOs	Evaluation Methods	Reference
<b>Review</b> Life Distributions, Models and Their Characteristics.	1		1		
<b>Structural Properties of Coherent Systems</b> Structural functions, union/intersection methods, representation of coherent systems in terms of paths and sets.	2		1+2		
<b>Reliability of Coherent Systems</b> Reliability functions of systems with either independent or dependent components, a stochastic inequality.	2		2+6		
<b>Families of Probability Distributions in System Reliability Theory</b> Notion of aging, related families of life distributions with monotone (constant, increasing, decreasing) failure rates.	2		3		

<b>Classes of Life Distributions Based on Notions of Aging</b> IFR, IFRA, DFR, DFRA families of distributions, ordering of life distributions, a log-concavity property and DFR distributions, upper and lower bounds for reliability functions.	2.5		3+5		
<b>Multivariate Distributions of Systems with Dependent Components</b> Bivariate and multivariate life distributions, notions of multivariate dependence, multivariate monotone failure rate life distributions.	2.5		5+6		
<b>Selected Topics on Optimal Maintenance Policies</b> Renewal theory, replacement policy, availability theory	2		4+5		

## 21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

In order to succeed in this course, each student needs to be an active participant in learning – both in class and out of class.

- Lectures and discussion through the Class time
- Encourage the team work by discussion of some real reliability data
- Various sets of home-work will be assigned on different period of times.
- The solutions of the homework sets and the exams will be solved in the class to allow students to learn and figure out their mistakes.

## 22. Evaluation Methods and Course Requirements:

ILO/s	Learning Methods	Evaluation Methods	Related ILO/s to the program
	Lectures	Exams	
	Home works	Assignments	
	Discussions		

**23. Course Policies:**

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled time. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.
2. If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.
3. Medical certificates shall be given to the University Physician to be authorized by him. They should be presented to the Dean of the Faculty within two weeks of the student's ceasing to attend classes.
4. Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.
5. Solutions for the exams questions and marks will be announced to the students.
6. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on home-works

**24. Required equipment:** (Facilities, Tools, Labs, Training....)**25. References:**

1. Statistical Theory of Reliability and Life Testing, by R. E. Barlow and F. Proschan, 1981, To Begin With Silver Spring, MD (or later version).
2. Statistical Analysis of Reliability and Life Testing Models: Theory and Methods, by L. J. Bain and M. Engelhardt, Marcel Dekker Inc., 2<sup>nd</sup> Edition, 1991.

**26. Additional information:**

Name of Course Coordinator: Dr. M.Z.Raqab

Signature: ----- Date: -----

Head of curriculum committee/Department: Dr. M. Z. Raqab Signature: -----

Head of Department: Dr. M. Z. Raqab Signature: -----

Head of curriculum committee/Faculty: Dr.Ahmad. Zghoul Signature: -----

Dean: Dr. Fuad Kittaneh----- Signature: -----