Probability

Course Code:

MATH 281

Course Period:

Spring

Course Type:

Core

Credits:

3

Theoric:

2

Practice:

2

Laboratory Hour:

0

ECTS:

5

Course Language:

English

Course Objectives:

The aim of this course is to introduce fundamentals of Probability Theory to engineering students. In the course, the theoretical background for Probability Theory, and the use of probabilistic models and statistical methodology will be covered, fully. The important balance between the theory and methodology will be maintained throughout the course, demonstrating the use of the corresponding techniques through various applications in different branches of science and engineering.

Course Content:

To understand the fundamentals of probability theory and to be able to apply them.

Course Methodology:

1: Lecture, 2: Question-Answer

Course Evaluation Methods:

A: Testing, B: Quiz

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
Describe discrete data graphically and compute measures of centrality and dispersion	1, 2, 5, 11	1, 2	A, B
Compute probabilities by modeling sample spaces and applying rules of permutations and combinations, additive and multiplicative laws and conditional probability	1, 5	1, 2	A, B
Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance	1, 5, 11	1, 2	A, B
Compute probabilities based on practical situations using the discrete (binomial, hypergeometric, geometric, Poisson) and continuous distributions (normal, uniform, exponential)	1, 2, 5, 11	1, 2	A, B
Use the normal distribution to test statistical hypotheses and to compute confidence	1, 5, 11	1, 2	A, B
Appraise inferential statistics, evaluate population parameters, and test hypotheses made about population parameters	1, 2, 5, 11	1, 2	A, B

Week	Topics	Study Materials - 1	Study Materials - 2
1	Introduction to Probability and Statistics. Statistical Experiments. Outcomes. Events. Sample Space. Set Theory.	Textbook-1; 2.1, 2.2	Textbook-2; 2.1

2	Interpretations and Axioms of Probability. Basic Theorems of Probability. Finite Sample Spaces. Counting Techniques. Multiplication Rule. Permutations. Combinations. Sampling With and Without Replacement.	Textbook-1; 2.3, 2.4, 2.5	Textbook-2; 2.2, 2.3
3	Independence of Events. Conditional Probability. Bayes' Theorem.	Textbook-1; 2.6, 2.7, 2.8	Textbook-2; 2.4, 2.5
4	Discrete Random Variables. Probability Function. Distribution Function. Mean and Variance.	Textbook-1; 3.1, 3.2, 4.1 (discrete), 4.2 (discrete),	Textbook-2; 3.1, 3.2, 3.3, 3.4
5	Special Discrete Distributions (Uniform, Bernoulli, Binomial, Hypergeometric,).	Textbook-1; 5.1, 5.2, 5.3,	Textbook-2; 3.5, 3.6, 3.7
6	Geometric, Negative Binomial, Poisson Distributions	Textbook5.4, 5.5, 5-6	Textbook-2; 3.6, 3.7
7	Continuous Random Variables. Probability Density Function. Review exercises. EXAM I	Textbook-1; 3.3, 4.1 (cont.), 4.2 (cont.)	Textbook-2; 4.1, 4.2
8	Special Continuous Distributions (Uniform, Normal, Normal Approximation to Binomial, Gamma, Exponential).	Textbook-1; 6.1, 6.2, 6.3, 6.4	Textbook-2; 4.3, 4.4, 4.5

9	Special Continuous Distributions (Uniform, Normal, Normal Approximation to Binomial, Gamma, Exponential).	Textbook-1; 6.5, 6-6, 6.7	Textbook-2; 4.3, 4.4, 4.5
10	Joint, Marginal and Conditional Distributions. Covariance and Correlation. Conditional Mean and Variance. Independence of Random Variables.	Textbook-1; 3.4	Textbook-2; 5.1, 5.2,
11	Covariance and Correlation. Conditional Mean and Variance. Independence of Random Variables.	Textbook-1; Rest of chapter 4	Textbook-2; Rest of chapter 4
12	REVIEW PROBLEMS, EXAM II	Textbooks	Textbooks
13	Introduction to Statistics and Data Analysis	Textbook-1; Chapter 1 Chapter 8.1-8.6	Textbook-2; Chapter 1
14	Hypothesis Testing	Textbook-1; Chapter 10	Textbook-2; Chapter 9

Textbooks	**TEXT BOOK-1**: Probability & Statistics for Engineers and Scientists, R.E. Walpole, R.H. Myers, S.L. Myers, and K. Ye, 8th Edition, Prentice Hall, 2007 **OR** **TEXT BOOK-2 :** Modern Mathematical Statistics with Applications, Jay L. Devore,Kenneth N. Berk, Springer
Additional Resources	• Applied Statistics and Probability for Engineers, D.C. Montgomery, G.C. Runger, Wiley. • Probability and Statistics for Engineering and the Sciences, J.L. Devore.

Documents	

Assignments	
Exams	

IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	50
QUIZ	5	10
Lab Work	0	
Term Project		
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

No	**Program Learning Outcomes**	**Contribution**					
		1	**2**	**3**	**4**	**5**	
1	an ability to apply knowledge of mathematics, science and engineering					**X**	
2	an ability to design and conduct experiments, as well as to analyze and interpret data			**x**			
3	an ability to design a system, component or process to meet desired needs						
4	an ability to function on multi-disciplinary teams						
5	an ability to identify, formulate, and solve engineering problems					**x**	
6	an understanding of professional and ethical responsibility						
7	an ability to communicate effectively						
8	the broad education is necessary to understand the impact of engineering solutions in a global and societal context						
9	a recognition of the need for, and an ability to engage in life-long learning						

10	a knowledge of contemporary issues						
11	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice					**x**	

Activities	**Quantity**	**Duration (Hour)**	**Total Workload (Hour)**
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Midterm examination	2	2	4
Quiz	5	1	5
Final examination	1	3	3
Total Work Load			116
Total Work Load / 25 (h)			5
ECTS Credit of the Course			5