Course Title: *Probability and Statistics, IESM 106*
Number of Credits: 3
Instructor Name: *Victor Ohanyan.*
Email Address: *victo@aua.am*
Telephone Number: *093-21*-59-03
Office Location: ??
Office Hours: ***Victor Ohanyan*** *Monday&Wednesday: 13:30 – 14:20 or by an appointment*
Term/Year: Summer *2018, from June 18 till August10.*
Class Schedule: ??
Prerequisites: *One year of Calculus*
Co-Requisites: *None*

Course Description: This course is an introduction to the mathematical study of randomness and uncertainty. The course covers topics including: Properties of probability; Conditional probability and independence; Discrete and continuous random variables; Expectation, variance and covariance; Moments of random variables; Limit theorems; Central limit theorems; Special type of random variables that often occur in applications: Binomial, Polynomial, Poisson, Hyper-geometric, Normal, Uniform, Exponential, Lognormal, Gamma, chi-square, t- and F-distributions; Six- sigma rule; General principles of simulation; Random number generation; Random sampling; Point estimators, Method of moments; Method of maximal likelihood; The order statistics; Confidence intervals on mean, variance and population proportion; Hypothesis testing; Chi-square goodness of fit test; Forecasting techniques; Linear regression model; Queuing models.

The attendance of these sessions is mandatory.

In order for the course to be considered passed, for undergraduate students a minimum grade is D-, while for master students a minimal grade is C-.

Required Materials:

Main textbooks:

1. ``A First Course in Probability", Sheldon Ross, Fourth edition, Macmillan College Publishing Company, 1994.
2. ``Introduction to Probability and Statistics", Victor K. Ohanyan, (These lectures have been written for an introductory course in Probability and Statistics for students of College of Science and Engineering of AUA), AUA, 2018.
3. Miller & Freund's Probability & Statistics for Engineers", Richard A. Johnson, Fifth edition, Prentice Hall, Englewood Cliffs, New Jersey, 1994.

Additional textbooks:

4.``Introduction to Probability Models", Sheldon Ross, Academic Press, New York, 9th edition, 2007.
5. Sheldon Ross, ``Introduction to Probability and Statistics for Engineers and Scientists", Academic Press, Elsevier, 3rd edition, 2004.

Site for E-textbooks:

https://drive.google.com/folderview?id=0Byvwcrd2OGsIS3liRnRTYjVlQkE&usp=sharing

Schedule & Topics*:*

Week	Topic	Reading	Non-Reading Home Tasks
1	Elementary introduction to Probability: • Sample space and events; • Properties of Probability; • Conditional probability and independence; • Geometric probabilities; • Finite sample spaces; • Total probability and Bayes' formulae; • Independent trials, Polynomial law; • Poisson law; • Hyper-geometric probability model;	(1), (2)	Home work #1
2	Concept of Random Variables: • Discrete and continuous distributions; • Joint distribution functions; • Independent random variables; • Discrete and continuous distributions; • Joint distribution functions; • Independent random variables; • Expectation, variance; • Covariance of random variables	(1), (2) (3)	Home work #2
3	Concept of Random Variables: • Special type of random variables that often occur in applications; Six-sigma rule; • General principles of simulation; • Random number generation; Summary and synthesis of topics in Weeks 1-6; **The first Midterm Examination**	(1), (2), (3)	Home work #3
4	Limit theorems: • Markov and Chebyshev inequalities; • Law of Large numbers; • Central limit theorems; • Some applications of limit theorems;	(1), (2), (3)	Home work #4
5	Elementary introduction to Statistics: • Random Sampling; • Consistency; • Moments and Maximal likelihood methods; • Confidence intervals;	(1), (2), (5)	Home work #5
6	Hypothesis Testing: • Significance levels; • Chi-square goodness of fit test; • Tests concerning the mean of a normal population; • Forecasting techniques; Summary and synthesis of topics in Weeks 7-12; **The second Midterm Examination**	(1), (2), (3), (5)	Home work #6
7	Some additional topics: • Linear regression model; • The least squares method; • Queuing models **Final examination**	(2), (3), (5)	

Learning Outcomes:
The following chart shows alignment between course-specific and program learning outcomes and goals as identified in Program Curriculum Map.

Course Outcomes	**Program Student Learning Outcomes** Students will be able to:	***Program Goal***
1.1 Construct estimates and bounds using limit theorems; 1.2 Construct relevant probability models for random experiments; 1.3 Applications of random processes in time-dependent engineering models; 2.1 Develop students' skills in identifying, formulating, and solving probability engineering problems; 2.2 An understanding of the fundamental concepts of the probability; 2.3 The ability to use probabilistic reasoning to solve engineering problems. 3 Develop students' skills in comparing alternative models and justify their selection;	The students completing the course are expected to possess the following skills and abilities: 1. Collect data and be able to interpret, analyze and draw appropriate conclusions. 2. Identify, formulate and solve engineering problems through the techniques, skills and modern tools of Industrial Engineering. 3. Consider alternatives and make a decision based on a proper engineering/scientific/business justification	To define, diagnose, and solve real-life problems from an industrial engineering and systems perspective and within a multi-disciplinary, enterprise-wide context

Method of Evaluation *Student learning will be evaluated on the basis of the following weighted components:*

Midterm 1	*20 %*
Midterm 2	*20 %*
Final Exam	*40 %*
Quizzes	*10 %*
Homework	*10 %*
Total Points	*100 %*

So the Grade Calculation Formula is:

$$\textbf{Total} = 0.1*(Q + HW) + 0.2*(M1 + M2) + 0.4*F$$

Grading Scale:

Highest	Lowest	Letter	Grade Points
100.00%	98.00%	A+	4.0
97.99%	94.00%	A	4.0
93.99%	90.00%	A-	3.7
89.99%	87.00%	B+	3.3
86.99%	83.00%	B	3.0
82.99%	80.00%	B-	2.7
79.99%	77.00%	C+	2.3
76.99%	73.00%	C	2.0
72.99%	70.00%	C-	1.7
69.99%	67.00%	D+	1.3
66.99%	63.00%	D	1.0
62.99%	60.00%	D-	0.7
59.99%	0.00%	F	-

Class attendance and participation:
Students are expected to attend class and demonstrate their understanding of topics by participating in class discussions. Please see the rubric for class participation criteria.
Quizzes: There will be one quiz given in class every week except for the first week of classes.
Quizzes will not be announced in advance and no make-up quiz will be given for the missed one, unless a valid proof of a University authorized absence is presented.

Exams: The course will include two mid-term exams covering topics from weeks 1 to 3 and 4 to 6 correspondingly as well as a comprehensive final exam covering all course topics with an emphasis on topics covered in week 7. All problems have equal weight.

Topic of assessment: Learning objective #1 – Data Analysis Rubric

	Advanced	**Proficient**	**Developing**	**Not Competent**
Treats data appropriately	Correctly interprets data and is able to draw suitable accurate conclusions from the data.	Interprets data and is able to draw conclusions from the data. There are few inaccuracies in analysis.	Attempts to interpret data to draw conclusions from the data. There are inaccuracies in analysis.	Makes no attempt to analyze data or draw conclusions or the analysis is fundamentally flawed.
Manipulates data correctly	Students can appropriately manipulate data using suitable formulae or equations.	Students can manipulate data using formulae or equations. The data manipulation makes analysis possible Some errors are present in data manipulation.	Students can manipulate data with use of formula or equations. Some errors are present in data manipulation.	Students make no attempt to manipulate data or manipulation is fundamentally flawed.
Understands data types correctly	Recognizes data types – continuous and discontinuous.	Recognizes data types – continuous and discontinuous, but most of the time.	Has some understanding of data types – continuous and discontinuous.	Shows little understanding of data types.

Topic of assessment: Learning objective #2 - Problem Solving Rubric

	Advanced	**Proficient**	**Developing**	**Not Competent**
Understands the problem	Identifies special factors that influence the approach before starting the problem	Understands the problem	Understands enough to solve part of the problem or to get part of the solution	Doesn't understand enough to get started or make progress
Uses information appropriately	Explains why certain information is essential to the solution	Uses all appropriate information correctly	Uses some appropriate information correctly	Uses inappropriate information
Applies appropriate procedures	Explains why procedures are appropriate for the problem	Applies completely appropriate procedures	Applies some appropriate procedures	Applies inappropriate procedures
Answers the problem	Correct solution of problem with explanations and conclusions	Correct solution	Copying error, computational error, partial answer for problem	No answer or wrong answer based upon an inappropriate plan

			with multiple answers, no answer statement, answer labeled incorrectly.	

Topic of assessment: Learning objective #3 – Alternative Consideration Rubric

	Advanced	**Proficient**	**Developing**	**Not Competent**
Distinguishes between alternative probabilistic models	Identifies multiple approaches for solving the problem, all of which apply within the specified context.	Identifies multiple approaches for solving the problem, only some of which apply within the specified context.	Identifies only single approaches for solving the problem that does apply within the specified context.	Identifies one or more approaches for solving the problem that do not apply within a specified context.
Clearly justifies the selection	Proposes one or more solutions/hypotheses indicating a deep comprehension of the problem. Solutions/hypotheses are sensitive to contextual factors.	Proposes one or more solutions/hypotheses indicating overall comprehension of the problem. Solutions/hypotheses are sensitive to most of contextual factors.	Proposes one solution/hypothesis that is "off the shelf" rather than individually designed to address the specific contextual factors of the problem.	Proposes a solution/hypothesis that is difficult to evaluate because it is vague or only indirectly addresses the problem statement.

Attendance and participation rubric

	Exceeds Expectations	**Meets Expectations**	**Below Expectations**	**Not Acceptable**
Class Participation	Attends class regularly and always contributes to the discussion by raising thoughtful questions, analyzing relevant issues, building on others' ideas, synthesizing across readings and discussions.	Attends class regularly and sometimes contributes to the discussion in the aforementioned way.	Attends class regularly but rarely contributes to the discussion in the aforementioned way.	Attends class irregularly and never contributes to the discussion in the aforementioned way.

Library and Media/Technology Use
Students are encouraged to use supplemental online and reference materials available at the library to enhance their overall learning in the course. If students have any questions or need additional support in using library resources or technology, they should confer with library staff, ICT, or the instructor.

Make-up Procedures
Students are required to take tests and exams when they are scheduled by the instructor. In the event that a student misses a test or exam, the instructor is under no obligation to give a make-up, unless the student brings convincing, objective evidence that it was impossible for the student to

take it at the scheduled time due to a medical or other emergency. Students should give instructors written notice of any absences from tests or exams before the test or exam.

Policy on Grade Appeal
Students are entitled to appeal grades in line with the university's grade appeal policy which is available online at http://aua.am/policies

Standards for Academic Integrity
Students are required to conduct themselves in an academically responsible and ethical manner in line with the Student Code of Ethics. Acts of academic dishonesty impair the academic integrity of AUA and create an unfair academic advantage for the student involved and other member(s) of the academic community. These acts are subject to disciplinary measures as prescribed in the AUA Code of Student Ethics (http://aua.am/wp-content/uploads/2012/02/stud_code_ethics.pdf)

Special Needs:
Students requiring special accommodations for learning should contact the Center for Student Success by the end of the Drop/Add period with such requests. studentsuccess@aua.am, http://studentsuccess.aua.am/disability-support-services/