| Course Title | Probability and Statistics | | | |
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| Course Code | AMAT 300 | | | |
| Course Type | Required | | | |
| Level | BSc (Level 1) | | | |
| Year / Semester | 2nd /2nd | | | |
| Teacher's Name | Dr Tsolaki Eleni | | | |
| ECTS | 5 | Lectures / week | 3 | Laboratories/week |
| Course Purpose | Probability theory and statistical methods play an important role in many aspects of engineering, including forecasts of extreme operating conditions, the optimization of industrial processes, the reliability of mechanical systems and the quality assurance of the manufacturing products. The purpose of this course is to introduce students to the notion of probability and statistics and to introduce the mathematical tools that are used to describe them. In addition, the course then will make the link between the mathematics and engineering applications. In this context, students will study and perform analysis for a number of examples from real life applications. | | | |
| Learning Outcomes | 1. Use descriptive statistics to present data by constructing Bar Charts, Pie Charts, Histograms and Box Plots. | | | |
| | 2. Explain and apply measures of central tendency such as mean, median and mode, measures of Dispersion such as Range, IQR, Variance and standard deviation and the coefficients of Variation and Skewness to different types of data. | | | |
| | 3. Describe the notion of sample space for an experiment, describe events as subsets of the sample space and construct events by using set theoretic operations and with the use of Venn diagrams. | | | |
| | 4. Construct the probability function on the space of events with its properties, define conditional probability and calculate probabilities of events in simple problems. | | | |
| | 5. Describe the concepts of discrete and continuous random variables as functions from the sample space to the set of real numbers and explain and use the probability distribution function and cumulative distribution function to calculate simple probabilities. | | | |
| | 6. Calculate the expected number, variance and standard deviation of a random variable and use discrete and continuous distributions in examples to calculate probabilities in real life problems. | | | |
| | 7. Calculate point estimators and construct confidence intervals for means and proportions of one and two populations. | | | |

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| | 8. Test hypothesis for means, proportions and difference of means, apply hypothesis testing to real life problems and construct linear models for a given set of data using linear regression. |
| Prerequisites | AMAT122      Corequisites      None |
| Course Content | 1. Descriptive Statistics: Introduction to Statistics, Data Collection, Describing and Summarizing Data, Measures of Central Tendency, Dispersion and Skewness, Tables, Charts, Exploratory Data Analysis. <br> 2. Probability: Sample Spaces and Events. Introduction to set theory and relations in set theory. Definitions of Probability and properties. Conditional probability. <br> 3. Discrete Random Variables: Probability Distribution Function and cumulative distribution function, Mathematical Expectation, Mean and Variance. Probability Distributions: Binomial, Poisson. <br> 4. Continuous Random Variables: Probability density Function and cumulative distribution function, Mathematical Expectation, Mean and Variance. Probability Distributions: Uniform, Normal Distribution. Approximations for Discrete Distributions. <br> 5. Sampling distributions: Properties of sample distributions: Unbiasedness and minimum variance. The central limit theorem. <br> 6. Estimation: Confidence Internal Estimation for Mean, Proportion, Difference of Means, Difference of Proportions. Sample size determination. <br> 7. Hypothesis Testing: Hypothesis Testing for Mean, Proportion, Difference of Means, Difference of Proportions. <br> 8. Introduction to regression: Simple Linear Regression and Correlation. |
| Teaching Methodology | The course is delivered to the students by means of lectures, conducted with use of PowerPoint presentations and the whiteboard. <br><br> The students are also engaged in the course through questions by the lecturer which are discussed in class. <br><br> Several examples are solved on the white board, with the participation of students. Students are encouraged to leave their seats and solve examples on the board as well. <br><br> Students are asked to work on their own during class hours on practice problems, and they are encouraged to ask questions. <br><br> Many additional exercise sheets and material is available to students through the e-learning platform. <br><br> Students are encouraged to attend office hours for extra help. |
| Bibliography | <u>(a)Textbooks:</u> <br><br> • Morris H. DeGroot, Mark Schervish, *Probability and Statistics*, 5th edition, 2019. <br><br> <u>(b) References:</u> |

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| | - Paterson, Hennessy, *Computer Organization and Design: the Hardware/Software Interface*, Morgan Kaufman, 2008<br>- M.L. Beverson, D.M. Levine, and D. Rindskopf, *Applied Statistics, A first course,* Prentice-Hall Int. Editions<br>- J. T. McClave, T. Sincich, W. Mendenhall, *Statistics,* 11th Ed., Prentice Hall, 2007<br>- R.V. Hogg and E.A. Tavis, *Probability and Statistical Inference*, Macmillan Publishing Co., Inc. New York |
| Assessment | (a) <u>Methods:</u> Students will be assessed with coursework that involves two in class written tests and a final exam.<br>(b) <u>Criteria:</u> Assessment criteria are available in each test or in the final exam<br>(c) <u>Weights:</u><br>    - Tests                             40%<br>    - Final Exam                 60% |
| Language | English language |