Far Western University
Faculty of Engineering
Bachelor of Computer Engineering
(Course of Study 2075)

Course Title: Probability & Statistics	**Credit: 3**
Course Code.:	**Number of lecture/week: 3**
Nature of the Course: Theory	**Tutorial/week: 1**
Year/Semester: III/V	**Total hours: 45**

1. **Course Introduction**
   Many computer processes are probabilistic. To understand and model them, having fundamental understanding of the probability theory and collecting statistics is required. Therefore, this course is introduced to provide the fundamental knowledge of the probability and statistics with some application in computer engineering.
2. **Course Objectives**
   This course aims to provide the fundamental knowledge of probability and statistics to computer engineering undergraduate students. After carefully study of this course students can able to
   - Understand the role of statistics in engineering
   - Understand and apply the basic probability and probability distribution
   - Collect, visualize, and summarize the statistics
   - Understand the estimation and hypothesis testing and apply it when necessary
   - Understand the relationship between variables and apply it when necessary
3. **Course Outline**
   This course provides the introductory concept of basic probability, random variable, probability distributions, data collection, visualization and description, estimation, hypothesis testing and bivariate relationships. Topics covered are; role of statistics in engineering, basic probability, discrete random variables and probability distributions, continuous random variables and probability distributions, joint probability distribution, random sampling and data description, point estimation and interval estimation of single sample, test of hypothesis for mean and proportion (single and double sample case), Simple linear regression and correlation.

Specific Objective	Contents (Unit/ Chapter)	Duration
After carefully study of this chapter students can able to identify the role of the statistics in the engineering problem solving process & discuss how probability and probability models are used in engineering and science. In addition, students can able to identify the process of collecting engineering data	**CHAPTER 1** **Role of Statistics in Engineering** 1.1The Engineering Methods and Statistical Thinking 1.2Collecting Engineering Data Basic Principles, Retrospective Study, Observational Study, and Designed Experiments	2 hours
After carefully study of this chapter students can able to • Understand the basic terminologies of the probability.	**CHAPTER 2** **Probability** 2.1Sample Spaces and Events Random Experiments, Sample Spaces, Events	5 hours

• Calculate and interpret the probability of single and joint event. • Interpret and calculate conditional probabilities of events and Bayes' theorem • Understand random variables	2.2 Interpretations of Probability Introduction and Axioms of Probability 2.3 Addition and Multiplicative rules 2.4 Conditional Probability 2.5 Bayes' Theorem 2.6 Random Variables	
After careful study of this chapter students should be able to do the following: • Determine probabilities from probability mass functions and probability distribution function, and the reverse • Calculate means and variances for discrete random variables • Calculate probabilities, determine means and variances for each of the discrete probabilitydistributions presented	**CHAPTER 3** **Discrete Random Variable and Probability Distribution** 3.1 Discrete Random Variables 3.2 Probability Distributions andProbability Mass Functions 3.3 Cumulative DistributionFunctions 3.4 Mean and Variance of a Discrete Random Variable 3.5 Binomial Distribution 3.6 Geometric and Negative Binomial Distribution 3.7 Poisson Distribution	6 hours
After careful study of this chapter students should be able to do the following: • Determine probabilities from probability density functions. • Determine probabilities from cumulative distribution functions and the reverse • Calculate means and variances for continuous random variables • Calculate probabilities, determine means and variances for each of the continuous probabilitydistributions presented	**CHAPTER 4** **Continuous Random Variables & Probability Distribution** 4.1 Continuous Random Variables 4.2 Probability Distributions and Probability Density Functions 4.3 Cumulative Distribution Functions 4.4 Mean and Variance of a Continuous Random Variable 4.5 Continuous Uniform Distribution 4.6 Normal Distribution 4.7 Normal Approximation to the Binomial and PoissonDistributions 4.8 Exponential Distribution 4.9 Gamma Distribution 4.10 Beta Distribution	7 hours
After careful study of this chapter student should be able to do the following: • Use joint probability mass functions and joint probability density functions to calculate probabilities • Calculate marginal distributions from joint probability distributions	**CHAPTER 5** **Joint Probability Distributions** 5.1 Jointly Distributed Random Variables Joint Probability Distributions, Marginal Probability Distributions, and Independence of Random Variables	4 hours
After careful study of this chapter students should be able to do the following: • Compute and interpret the mean, variance, standard deviation, mode median, and sample range • Construct and interpret visual data displays, including the stem-and-leaf display, the histogram, the box plot, time plots, the bar diagram and pie diagrams	**CHAPTER 6** **Random Sampling & Data Descriptions** 6.1Data Summary and Dispersion (Mean, Median, Mode, Range, Quartile Deviation, Inter-Quartile Range, Standard Deviation, Coefficient of Variation) 6.2 Random Sampling 6.3 Stem-and-Leaf Diagrams 6.4 Frequency Distributions andHistograms 6.5 Box Plots 6.6 Time Sequence Plots 6.7 Probability Plots	6 hours

	6.8 Bar and Pie Diagrams	
After careful study of this chapter students should be able to do the following: • Explain the general concepts of estimating the parameters of a population or a probability distribution • Explain important properties of point estimation • Understand the central limit theorem • Construct and interpret the confidence interval of mean and proportions	**CHAPTER 7** **Estimation** 7.1 General Concepts of PointEstimation and Criteria of Good Estimator 7.2 Sampling Distributions 7.3 Sampling Distribution of Means (Central limit Theorem) 7.4 Interval Estimation Confidence Interval of single mean and Proportion, Determination of Sample Size	5 hours
After careful study of this chapter students should be able to do the following: • Structure engineering decision-making problems as hypothesis tests • Test the hypotheses on the mean of a normal distribution using either a *Z*-test or a *t*-test procedure (One sample and two sample case) • Test hypotheses on a population proportion (One sample and two sample case)	**CHAPTER 9** **Hypothesis Testing** 8.1 Steps in Performing Hypothesis Testing 8.2 Critical Region and Level of Significance 8.3 Types of Error in Hypothesis Testing and Power of the test 8.4 One Sample Test of Means (Small sample and large sample cases)and Proportions (use critical value approach and *p-value* approach) 8.5 Two Sample Test of Means (small sample and large sample cases) and Proportions (use critical value approach and *p-value* approach)	6 hours
After careful study of this chapter, students should be able to do the following: • Use simple linear regression for building empirical models to engineering and scientific data • Understand how the method of least squares is used to estimate the parameters in a linear regression model • Test statistical hypotheses on regression model parameters • Apply and calculate the correlation coefficient	**CHAPTER 10** **Simple Correlation and Regression Analysis** 9.1 Simple Correlation Analysis (scatter plots, Pearson's coefficient of correlation, test for significance of correlation coefficient) 9.2 Simple Linear Regression Analysis (method of least square estimation, test for significance of regression coefficient, coefficient of determination, assumption of simple linear regression)	4 hours

4. Project work:

Students are required to submit at least one project. It must be written in the format prescribed by APA 6th edition.

5. Tutorials:

One tutorial class should be assigned every week. For tutorial work students are recommended to use R3.5.1 or SAS or Minitab. Instructors are required to assign at least one assignment to the students every week.

6. References:

Montgomery, D.C.&Runger, G.C. (2003). *Applied Statisticsand Probabilityfor Engineers*. New York:*John Wiley & Sons, Inc. (3rd and higher edition)*

Ross, S.M. (2014). *Introduction to Probability and Statistics for Engineers & Scientist*. London: ELSEVIER. (5th and higher edition)

Jonson, R.A. (2010). *Probability & Statistics for Engineers*. England; Pearson. (9th and higher edition)