SYLLABUS

Date/ Revision   September 28, 2016
Faculty   Engineering
Approval   Dean Faculty of Engineering

SUBJECT : STATISTICS & PROBABILITY

1   Identification of Subject:

Name of Subject   :   Statistics & Probability
Code of Subject   :   MATH -2500
SKS/ECTS   :   2/3
Semester   :   4
Study Program   :   B-AVE/B-ELE/B-INE/B-MEE/B-MTE
Lecturer   :   • **To be appointed**

2   Competency (Learning Outcome)

- At the end of the course students will have an overview of the most important methodological approaches and concepts of statistics for engineering applications.
- After completing the course, students will be able to describe the core aspects of engineering statistics and able to illustrate, contrast, and apply the main concepts and theories of statistics
- Through the successful participation in this course students are able to recognize and to implement statistics into their daily engineering activities, especially for analysis objectives
- Through this course, students are able to use necessary software statistics tools/applications.

3   Description of Subject:

This course is providing students with mathematical and software tools for data analysis. The theory of statistics and its implementation to engineering and scientific field are introduced and explored. Software application using R language is used to provide a hands-on experience for implementing theory into data analaysis. Practical sessions using R language are provided, and small project is introduced to test student capabilities.

4   Learning Approach

Approach   :   Combination of Expository - inquiry and colaborative
Method   :   Discussions, Questions/answers, Video , Sample problems/cases, Group works, Software exercises
Student Task   :   Home work, Presentation
Media   :   LCD projector

5   Evaluation

Maximum absences	:	25%
Paper (Personal)	:	20 points
Presentation (Group)	:	20 points
Quizzes (Personal)	:	20 points
Final Examination	:	40 points
Total	:	100 points

1. Contents/ Topics of Lecturing:

Week	Topics	Content	Remark
1	Probability theory	• Probability • Events, Combination of Events • Conditional Probability • Probabilities of events intersections • Posterior probability • Counting techniques • Case Study : micro-electronics solder joints, workpiece machining accuracy • R application: Introduction to R language (software tool)	Chapter 1[a] Chapter 1-2[b]
2	Random Variables	• Discrete Random Variables • Continuous Random Variables • The Expectation of a Random Variables • The Variance of a Random Variables • Jointly Distributed Random Variables • Combination and Functions of Random Variables • Case Study: Microelectronics solder joints, Workpiece Machining Accuracy • R application: Preparing & Manipulating Your Data	Chapter 2 [a] Chapter 3 [b]

Week	Topics	Content	Remark
3	Discrete Probability & Distributions	• The Binomial Distribution • The Geometric and Negative Binomial Distributions • The Hypergeometric Distribution • The Poison Distributions • The Multinomial Distribution • Case Study : Microelectronics solder joints, Workpiece Machining Accuracy • R application: Combining and Structuring Datasets	Chapter 3 [a] Chapter 4 [b]
4	Continuous Probability Distributions	• The Uniform Distribution • The Exponential Distribution • The Gamma Distribution • The Weibull Distribution • The Beta Distribution • Case Study : Microelectronics solder joints, Geometric Accuracy of Prismatic Machined Parts • R application: Summary Statistics for Continuous Variables, Tabular Data	Chapter 4 [a] Chapter 5,6 [b]
5	Exercises with R language	• R application: Probability Distribution, Creating Plots, Customizing Plots	Chapter 7,8,9 [b]
6	The Normal Distribution	• Probability Calculation Using the Normal Distribution • Linear Combinations of Normal Random	Chapter 5 [a]

Week	Topics	Content	Remark
		• Variables • Approximating Distributions with the Normal Distribution • Distributions Related to Normal Distribution	
7	Exercises with R language	• Hypothesis Testing • Regression and General Linear Models	Chapter 10, 11 [b]
8	Semester Break	•	
9	Descriptive Statistics	• Experimentation • Data Presentation • Case Study : Microelectronics, Quality Control of Workpiece Geometric	Chapter 6 [a] Analysis data using R language (practical-1)
10	Statistical Estimation and Sampling Distribution	• Point Estimates • Properties of Point Estimates • Sampling Distributions • Constructing Parameter Estimates	Chapter 7 [a] Analysis data using R language (practical-2)
11	Interference on Population Mean, and Comparing of Two Population Mean	• Confidence Interval • Hypothesis Testing • Analysis of Paired Samples • Analysis of Independent Samples • Case Study : Microelectronics Solder Joints • Case Study : Machine Tool Ball Bearing Geometric Quality Control	Chapter 8, 9 [a] Analysis data using R language (practical-3) Alternatively, students may also bring their case studies and present the analysis using R
12	Discrete Data Analysis	• Inferences on a Population Proportion • Comparing Two Population Proportions • Goodness of Fit Tests for One-Way Contigency Tables • Testing for Independence in Two-	Chapter 10 [a] R language practical-4

Week	Topics	Content	Remark
		Way Contigency Tables	
13	The Analysis of Variance, Simple Linear Regression and Correlation	• One-Factor Analysis of Variance • Randomized Block Designs • The Simple Linear Regression Model • Fitting the Regression Line • Inferences on the Slope Parameter • Inferences on The Regression Line • Prediction Interval for Future Response Values • The Analysis of Variance Table • Residual Analysis • Variable Transformations • Correlation Analysis	Chapter 11, 12 [a] Analysis data using R language (practical-5)
14	Multiple Linear Regression & Non Linear Regression, Multifactor Experimental Design & Analysis, Non-Parametric Statistical Analysis	• Introduction to multiple linear regression • Examples of multiple linear regression • Matrix Algebra Formulation of Multiple Linear Regression • Evaluating Model Accuracy • Non-Linear Regression • Experiment with Two Factors • Experiment with Three-More Factors • The Analysis of a Single Population • Comparing Two Populations	Chapter 13,14,15 [a] Alternatively, students may also bring their case studies and present the analysis using R
15	Quality Control Method, Reliability Analysis and Life Testing	• Statistical Process Control • Variable Control Charts • Attribute Control Charts • Acceptance Sampling	Chapter 16, 17 [a] Project Presentations

Week	Topics	Content	Remark
		• System Reliability • Modeling Failure Rates • Life Testing • Small Project : Geometric Measurement of Simple/Complex Machining Parts/Components • Small Project : Maintenance Management Systems Data Analysis	
16	**Silent Week: make-up classes only**		
17	**Final Examination**		

Reference:

Main Reference:

a) Hayter, Anthony, *Probability and Statistics for Engineers and Scientists,* 4th edition, Cengage Learning, 2013

b) Stowell, Sarah, *Using R for Statistics*, Apress, 2013