**COURSE OUTLINE**

**for**

**INTRODUCTION TO PROBABILITY**

**AND**

**MATHEMATICAL STATISTICS**

**AND**

**RANDOM PROCESSES**

**Course Code:** **No. of Credits: 3**

**Instructor:** ***Prof. Nguyen Van Thu, Dr.Sc.***

**A. COURSE OVERVIEW:**

1. **Course Objective**: The course is aimed to provide the begininng students in engineering with the simple concepts and techniques of probabilistic and statistics models and random processes which are useful tool to deal with uncertainty situations.
2. **Prerequisite**:Students should have completed Calculus I and II.
3. **Major Contents**:
4. Probability: sample space and events, Venn Diagram and algebra of events, probability of event; probability rules (*addition rule, conditional probability, multiplication rule, total law, Bayes rules),* independence; random variables and their distributions, functions of random variables; expectation and variance.
5. Statistical Inference: parameter estimation, hypothesis testing and linear regression
6. Random process: Markov chain (transition probability, unconditional distribution, state classification and stationary distribution)
7. **Assessment**:
   1. **Progress**: 20% (10% Quiz, 5% Homework, 5% Attendance)

**Progress =min(50%\*Overall Quiz + 25%\*Overall homework + 25\* Attendance + Bonus from work in class, 100)**

*Overall quiz: average of three best quizzes among four quizzes*. Quiz is taken in class (except for online session). If you do not attend the class and do a quiz outside of the class, the result will be canceled.

*Overall homework: average of homework score*. There is some homework after each session. The homework must be submitted on time on blackboard to get 100 points. In the case of late submission, some reduction will be applied.

*Attendance is taken randomly*.

* 1. **Midterm Exam**: 30%
  2. **Final Exam**: 50%

Both midterm and final exam are written examination without multiple choice questions.

**GPA = 20%\* Progress + 30%\*Midterm exam score + 50%\* Final exam score**

1. Reading list:

[1]. R.Walpole et al , *Probability and Statistics for Engineers and Scientists*, 9th edition.

[2]. S. Ross, *Introduction to Probability Models*, 9th edition.

[3]. R. Ross, *Introduction to Probability and Statistics for Engineers and Scientists*, 3th edition

**B. PLANNED LEARNING ACTIVITIES**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Topics** | **Content** | **Assessments** | **Resources** |
| **1, 2** | 1. Introduction to probability  2. Counting techniques | 1.1. Sample space  1.2. Events and event operations  1.3. Laws of probability  2.1. Inclusion – Exclusion principle  2.2. Counting with Venn diagram  2.3. Multiplication rule  2.4 Permutation and combination | Homework 1  Homework 2 | [1], [2] |
| **3, 4** | 3. Calculating probability | 3.1. Probability for experiment with equally likely outcome  3.2. Inclusion – exclusion formula  3.3. Conditional probability  3.4. Independence  3.5. Multiplication rule and Tree diagram  3.6. Total law  3.7. Bayes’ formula | Homework 3, 4  Quiz 1 | [1], [2] |
| **5-6** | 4. Discrete random variable  5. Continuous random variable | 4.1. Probability mass function  4.2. Cumulative distribution function   * 1. Probability density function   2. Cumulative distribution function | Homework 5  Quiz 2 | [1], [2] |
| **7** | Special distribution | 8.1. Bernoulli distribution  8.2. Binomial distribution  8.3. Poisson distribution  8.4. Normal distribution | Homework 6 | [1], [2] |
| **8** | 7. Mean – Variance | 7.1 Mean  7.2. Variance | Quiz 3  Homework 7 | [1], [2] |
| **9, 10** | 9. Markov chain | 9.1. Transition probability  9.2. n- step transition probability  9.3. Unconditional distribution  9.4. State classification  9.5. Stationary distribution | Homework 8 | [2] |
| **11, 12** | 10. Introduction to statistics  11. Parameter estimation | 10.1. Introduction to statistics  10.2. Descriptive statistics  11.1. Estimate population mean  11.2. Estimate population proportion  11.2. Estimate population variance | Homework 9  Homework 10 | [1], [2] |
| **13, 14** | 12. Hypothesis testing | 12.1. Test for population mean  12.2. Test for population variance  12.3. Test for difference of means of two populations | Homework 11  Quiz 4 | [1], [2] |
| **15** | 13. Linear regression | 13.1 Linear regression and fitted line  13.2. Method of Least Squares Estimation  13.3. Quality of fit | Homework 12 | [1], [2] |

**------ THE END ------**