



**THUY LOI UNIVERSITY**  
**CIVIL ENGINEERING FACULTY**  
**CONSTRUCTION TECHNOLOGY**  
**AND MANAGEMENT DIVISION**

**SYLLABUS**  
Educated grade:  
Undergraduate

**ENGINEERING SYSTEMS AND DECISION ANALYSIS**

**Code: CIVE3066**

1. **Number of credits:** 3 [3.0.0]
2. **Class hours:** 45; in which Theory: 33; Assignments: 12;
3. **Education program for:**
  - *Compulsory: Civil Engineering.*
  - *Optional:*
4. **Assessment method:**

Form	No. of times	Description	Time	Weighted
Assignment	2 times	- No. 1: Chapter II	- Hours 9-15	10%
		- No. 2: Chapter IV	- Hours 34-39	10%
Quiz	5 times	- 10÷15 mins - Multiple choice/ written	- Every 2 weeks	10%
Attendance	All times	- Present at class	- All time	10%
<b>Summation of progressive assessment</b>				40%
Final test	1	- 90 mins - Oral defense/written	1-2 weeks after courses finished	60%

**5. Prerequisite conditions:**

- *Prerequisite class:* Hydrology, Hydraulic Engineering, Soil Mechanics.
- *Prior class:* Engineering Statistics, Mechanics of material, Structural Analysis , Reinforced concrete design, Steel design.

- *Parallel class*:

- *Others*: None

## 6. Brief content:

In dealing with real world problems, engineers make decisions about design, implementation, and operation of a system of interest. The decision making process requires an understanding of import system variables and processes, and the interactions between system components. In this context, uncertainties are unavoidable. The role of probability and statistics is quite pervasive in engineering; it ranges from the description of basic information to the development of models for design and decision making. This course covers basic statistical and probability concepts and methods that are useful for making decisions under uncertain conditions. The course materials are organized as follows:

- Exploratory data analysis
- Fundamentals of probability
- Random variables: distributions, functions, and moments
- Hypothesis testing and confidence intervals
- Building empirical models: Simple Linear Regression

The laboratory exercises aim to enhance students' capacity to implement statistical and probability methods. To this end, the MATLAB software is used.

## 7. Teaching Staff:

N o	Name	Academi c degree	Phone	Email	Job title
1	Nguyen Trong Tu	Assoc. Prof. Dr.	094505545 5	nguyentrongtu@tlu.edu.v n	Senior Lecturer , Head of division
2	Le Thai Binh	Dr.	098883173 6	lethaibinh@tlu.edu.vn	Senior Lecturer
3	Nguyen Thi Hue	Dr.	091728038 6	nguyenthihue@tlu.edu.vn	Senior Lecturer
4	Than Van Van	Dr.		thanvanvan@tlu.edu.vn	Senior Lecturer

## 8. Text books & Reference books

### *Text books:*

[1] Montgomery, D.C., G.C. Runger and N.F. Hubele, Engineering Statistics-Fifth Edition, John Wiley & Sons, Inc., ISBN-13: 978-0-470-63147-8. 2011.

### *Reference books:*

[1] Ang, A. and W. Tang, Probability Concepts in Engineering- Second Edition, John Wiley & Sons, Inc., ISBN-13: 978-0-471-72064-5.

## 9. Detailed content

Chapter	Content <sup>(1)</sup>	Teaching & learning activities <sup>(2)</sup>	Hours		
			Theory	Exercise	Field trip
1	<b>INTRODUCTION</b>  1.1 Introduction of various Civil Engineering structures  1.2 Role of probability and statistics in engineering: emphasis on civil and environmental applications	<b>* <u>Lecturer:</u></b>  - Lecturing  - Query  - Use practical images and problems  - Self-introduction for further communication  - Introduction of syllabus, assessment method, course content.  - Conveying experiences and study methodology.  <b>* <u>Student:</u></b>  - Answer queries  - Problem solving	3		

		<ul style="list-style-type: none"> <li>- Question the course (if necessary)</li> <li>- Implement of the work</li> </ul>			
2	<b>Chapter 2-1: Data summary and Presentation</b> 2.1 Descriptive statistics 2.2 Data processing 2.3. Plotting data 2.4 Empirical cumulative distribution function	* <u>Lecturer</u> : <ul style="list-style-type: none"> <li>- Lecturing</li> <li>- Query</li> <li>- Use practical images and problems</li> <li>- Conveying experiences and study methodology.</li> </ul> * <u>Student</u> : <ul style="list-style-type: none"> <li>- Answer queries</li> <li>- Problem solving</li> <li>- Question the course (if necessary)</li> <li>- Implement of the work</li> </ul>	3		
3	<b>Chapter 2-2: Fundamentals of probability</b> 3.1 Fundamentals of probability: review of basic concepts, mathematics of probability 3.2 Fundamentals of probability: conditional probability 3.3 Fundamentals of probability: examples	* <u>Lecturer</u> : <ul style="list-style-type: none"> <li>- Lecturing</li> <li>- Query</li> <li>- Use practical images and problems</li> <li>- Conveying experiences and study methodology.</li> </ul> * <u>Student</u> : <ul style="list-style-type: none"> <li>- Answer queries</li> <li>- Problem solving</li> <li>- Question the course (if necessary)</li> </ul>	3		

		- Implement of the work			
4	<p><b>Chapter 3: Random variables and probability distributions</b></p> <p>4.1 Introduction: definitions, type of random variables, experimental (empirical) cumulative distribution function, probability distribution of a random variable</p> <p>4.2 Continuous random variables: probability density function, cumulative distribution function, mean and variance</p> <p>4.2 Important continuous distributions: Normal distribution</p> <p>4.3 Important continuous distributions: Normal distribution examples</p> <p>4.4 Important continuous distributions: Lognormal, Exponential, Gamma, and Uniform distributions</p> <p>4.5 Continuous random variables examples, Probability plots</p> <p>4.6 Discrete random variables: probability mass function, cumulative distribution function, mean and variance</p> <p>4.7 Important discrete distributions: Binomial,</p>	<p>* <u>Lecturer</u>:</p> <ul style="list-style-type: none"> <li>- Lecturing</li> <li>- Query</li> <li>- Use practical images and problems</li> <li>- Conveying experiences and study methodology.</li> </ul> <p>* <u>Student</u>:</p> <ul style="list-style-type: none"> <li>- Answer queries</li> <li>- Problem solving</li> <li>- Question the course (if necessary)</li> <li>- Implement of the work</li> </ul>	12		

	<p>Geometric, Negative Binomial, and Poisson distributions</p> <p>4.8 Random variables: discrete random variables examples</p> <p>4.9 More than one variable and independence</p> <p>4.10 Functions of random variables: linear and nonlinear functions</p>				
	Exercises:	<p>* <u>Lecturer</u>:</p> <ul style="list-style-type: none"> <li>- Work assignment.</li> </ul> <p>* <u>Student</u>:</p> <p>Solving assignment</p>		6	
5	<p><b>Chapter 4: Decision making for a single sample</b></p> <p>5.1 Statistical inference and point estimation</p> <p>5.2 Hypothesis testing</p> <p>5.3 Inferences on the mean of a population with known variance</p> <p>5.4 Inferences on the variance of a normal population</p> <p>5.5 Testing for Goodness of Fit</p>	<p>* <u>Lecturer</u>:</p> <ul style="list-style-type: none"> <li>- Lecturing</li> <li>- Query</li> <li>- Use practical images and problems</li> <li>- Conveying experiences and study methodology.</li> </ul> <p>* <u>Student</u>:</p> <ul style="list-style-type: none"> <li>- Answer queries</li> <li>- Problem solving</li> <li>- Question the course (if necessary)</li> <li>- Implement of the work</li> </ul>	6		
6	<b>Chapter 5: Building empirical models</b>	<p>* <u>Lecturer</u>:</p> <ul style="list-style-type: none"> <li>- Lecturing</li> </ul>	6		

	6.1 Building empirical models: simple linear regression, least square parameter estimation 6.2 Simple linear regression: testing hypotheses 6.3 Simple linear regression: confidence and prediction intervals 6.4 Model adequacy and correlation analysis 6.5 Other aspects of regression: transformations	<ul style="list-style-type: none"> <li>- Query</li> <li>- Use practical images and problems</li> <li>- Conveying experiences and study methodology.</li> </ul> <p>* <u>Student</u>:</p> <ul style="list-style-type: none"> <li>- Answer queries</li> <li>- Problem solving</li> <li>- Question the course (if necessary)</li> </ul> <p>Implement of the work</p>			
	Exercises:	<p>* <u>Lecturer</u>:</p> <ul style="list-style-type: none"> <li>- Work assignment.</li> </ul> <p>* <u>Student</u>:</p> <p>Solving assignment</p>		6	
	Total	45	33	12	0

<sup>(1)</sup> Detailed content for heading 2 of every chapter.

<sup>(2)</sup> Preparation work for students and teaching and learning activities

## 10. Learning outcomes:

No .	Learning outcomes of the course	Learning outcomes of corresponding education program (3)
1	<p>Knowledge:</p> <ul style="list-style-type: none"> <li>- understanding of basic concepts of simulation and modeling, basic statistical concepts and measures</li> <li>- Basic understanding of mathematical programming and code development</li> </ul>	

2	Skills: - Write technical programming scripts in MATLAB.	
3	Independent and responsible capability (if any): - High responsibility in working and group work	
4	Individual ethics for profession, society (if any): - Be moral, be conscience, be disciplinary, be responsible for works, community and society.	

*<sup>(3)</sup> Learning outcomes of Corresponding Education Program was proposed by Head of specialization.*

## 11. Contacts

A. Address: Room 414 – A1 Building, Thuy loi University

B. Head of division: *(responsible for answering the queries from students and related partners)*

- Name: Assoc. Prof. Dr. Nguyen Trong Tu

- Phone: 0945055455

- Email: nguyentrongtu@tlu.edu.vn

*Ha Noi, Dated August, 12<sup>th</sup> 2021*

**DEAN**

*(In charge of education  
specialization)*

**DEAN**

*(In charge of course)*

**HEAD OF DIVISION**

**Assoc. Prof. Nguyen Trong Tu**