

# Course Description

## Ve401 Probabilistic Methods in Engineering

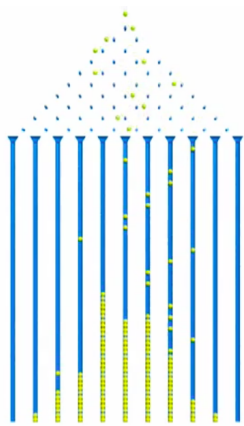


JOINT INSTITUTE  
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**Prerequisites:** Vv216 or Vv256 or Vv286 and the preceding calculus courses.



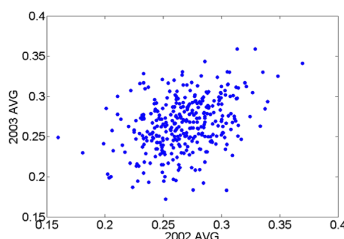
Gambling and Risk



Random Influences on Measurements



Statistics in the Middle Ages



Luck vs. Skill in Baseball

**Intended Audience:** ME and ECE undergraduate and graduate students.

**Description:** The first part of the course introduces some basic elements of probability theory and combinatorics, with proofs of theorems demonstrated as far as practical within the time constraints of the course. Students are expected to have a good knowledge of the standard calculus material of the first three terms, including, but not limited to, polar coordinates in higher dimensions, integration of single- and multiple-variable functions, the theory of convergence of series and sequences of functions, the theory of matrices and linear maps as well as systems of ordinary differential equations.

The second part of the course discusses some basic statistical methods for testing statistical hypotheses and analyzing means, variances and proportions. The results of the first part are applied to practical problems. Students are required to comprehend and interpret formulations of real-life situations, use their judgement and apply the correct procedure to find a suitable solution to a given problem. In this respect, the required skill sets are closer to a physics or engineering course than a mathematics course.

The third part of the course touches upon categorical data analysis, simple and multiple linear regression and analysis of variance (ANOVA). For regression problems in particular, familiarity with matrix calculus is required.

The course makes use of the Mathematica software, for which all JI students have a free license. The commands necessary for implementing statistical methods are given in the lecture at regular intervals.

The course will include two term projects.

**Keywords:** Basic concepts in probability, discrete and continuous probability distributions, joint distributions, descriptive statistics, estimation, hypothesis testing, non-parametric methods, analysis of categorical data, simple and multiple regression analysis, model selection, introduction to analysis of variance and experimental design.

## Literature:

[MA] Milton and Arnold, *Introduction to Probability and Statistics*, 4th Edition, McGraw Hill, International Edition 2004.

[HMGB] Hines, Montgomery, Goldsman and Borror, *Probability and Statistics in Engineering*, 4th Edition, 2003, J. Wiley & Sons.

## Syllabus:

Lecture	Date	Lecture Subject
1	2-3-2020	Elementary Probability
2	4-3-2020	Conditional Probability
3	5-3-2020	Bayes's Theorem; Discrete Random Variables
4	9-3-2020	Expectation and Variance
5	11-3-2020	Moment-Generating Function; Poisson Distribution
6	12-3-2020	Continuous Random variables
7	14-3-2020	The Normal Distribution
8	16-3-2020	Bivariate Random Variables
9	18-3-2020	Reliability
10	19-3-2020	Introduction to Statistics
11	23-3-2020	Point Estimation
12	25-3-2020	Interval Estimation
13	26-3-2020	Fisher's Significance Test
14	28-3-2020	<b>Midterm Exam</b>
15	30-3-2020	Neyman-Pearson Decision Theory
16	01-4-2020	T Test, Chi-squared Test
17	02-4-2020	Non-parametric Tests
18	06-4-2020	<i>Tomb-Sweeping Holiday</i>
19	08-4-2020	Inferences on Proportions
20	09-4-2020	Comparison of Two Variances
21	11-4-2020	Comparison of Two Means
22	13-4-2020	Categorical Data
23	15-4-2020	Simple Linear Regression
24	16-4-2020	Simple Linear Regression
25	20-4-2020	Multiple Linear Regression
26	22-4-2020	Multiple Linear Regression
27	23-4-2020	Analysis of Variance
28	27-4-2020	Analysis of Variance
29	29-4-2020	Analysis of Variance
30	30-4-2020	<b>Final Exam</b>

## Course Grade Components:

- Following online procedures and etiquette: 10%
- Midterm exam: 30%
- Final exam: 30%
- Term Project 1: 15%
- Term Project 2: 15%
- Course Work: 0% (see below)

Both term projects will be completed in groups of 4-5 students. The groups will be randomly assigned and will be different for both projects.

The course work (weekly assignments) will not contribute to the course grade, but each students needs to obtain at least 60% of the total marks of the assignments in order to receive a passing grade for the course. The course work will be completed by groups of 3 students which will remain unchanged throughout the term. Coursework will need to be submitted as a single typed manuscript per group.

## Honor Code Policy:

Students should familiarize themselves with JI's Honor Code, found at

<http://umji.sjtu.edu.cn/academics/academic-integrity/honor-code/>.

The standard rules for examinations apply. Furthermore, in group work (both projects and the course work) Section 5 of the Honor Code is fully enforced: any violation of the Honor Code by a group will cause all group members to be sanctioned equally. Finally, while communication between members of a group is completely unrestricted, communication between groups (even oral communication) is strictly prohibited.

The Teaching Assistants will be happy to answer any any questions regarding the application of the Honor Code.

## Addendum to the Honor Code for Online Courses in Spring 2020:

### *The Honor Code in the Context of Online Courses*

The JI Honor Code applies to courses taught in an online fashion in the same way that it does to all courses. It is worth repeating the central tenets here:

- Engineers must possess personal integrity as students and as professionals. They must honorably ensure safety, health, fairness, and the proper use of available resources in their undertakings.
- Members of JI are honorable and trustworthy persons.
- The students, faculty members, and staff members of JI trust each other to uphold the principles of the Honor Code. They are jointly responsible for precautions against violations of its policies.
- It is dishonorable for students to receive credit for work that is not the result of their own efforts.

In particular, the parts of the Honor Code regarding conduct during in-class examinations, for course-work, projects etc. apply correspondingly for such work conducted in courses taught online. Additional rules adapted to remote examinations, coursework etc. may be imposed as necessary.

In addition, students are required to abide by following rules specific to online teaching. These requirements are provisionally considered part of the Honor Code for the current teaching term.

Due to the new types of interaction and the new forms of learning activities there may be further issues that are not covered below. Students should not hesitate to contact their instructor, the Honor Council (jihonor@sjtu.edu.cn) or the FCD (jifcd@sjtu.edu.cn) if they have any questions.

#### *Online Presence and Activities:*

The Joint Institute imposes a “real name” policy for all online activities organized by JI instructors. This policy applies to groups or communication by E-Mail, Canvas, Piazza, Zoom, WeChat and all other platforms where groups are set up by JI or by individual instructors for students attending JI courses, events or other activities.

Students are required to use their actual name (in Pinyin) as part of their online presence for such groups and when communicating online. Individual instructors may also require students to add their name in Chinese characters (if applicable) and/or their Student ID.

Unless otherwise noted, such online activities are intended for the exclusive participation of JI students. Account names, meeting IDs, passwords and other information intended to protect the exclusivity of such activities may not be shared with anyone who is not part of the course or activity.

For example, it is not permissible to give a Zoom meeting ID of a given course to any person who is not enrolled in that course, whether or not the person is a JI student.

#### *Online Etiquette:*

When communicating or otherwise using online groups, students should follow the regulations set down by instructors concerning the use of online tools. Vandalism, spam messages, verbal and other forms of abuse, violation of English-only policies (as detailed by instructors) and disturbance of the learning experience of other students are not permitted.

#### *Teaching and Learning Materials:*

Teaching and learning materials, such as lecture slides, assignments, quizzes, videos etc. are copyrighted and may not be passed on to others without the express permission of the course instructor. This applies in particular to recordings of Zoom lectures and other videos created by instructors.

In particular, it is not permissible to upload videos to sharing platforms (such as Youku or YouTube) or to post lecture slides, assignment questions, project descriptions etc. on public sites such as SlideShare.