10. Probability and statistics for engineers (PH030IU)

Course designation	*This course develops an engineer's view of probability, started from the notion of chance, relative frequencies and then probability. It covers all fundamental concepts in probability, random variables and statistics that will serve everyday an engineer working in practical fields such as quality control, signal processing, biomedical engineering, automatic control, communications etc…*
Semester(s) in which the course is taught	1, 2, summer semester
Person responsible for the course	Department of Mathematics
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, project, seminar.
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the course	Previous course: Calculus 2 (MA003IU)

<table>
<tr><td>Course objectives</td><td>This course will provide students with:
Using data from a variety of sources such as quality control, signal processing, biomedical engineering, automatic control, communications etc
Contemporary computing and database environments, such as R/Python, and being exposed to case studies from outside the classroom.
Skill of formulating a practical problem related to probability and statistics in an analytical form in order to solve it.</td></tr>
<tr><td>Course learning outcomes</td><td>Upon the successful completion of this course students will be able to:
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<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Compute probability of simple and complicated events with probability rules; Evaluate probability, mean and variance of random variables and function of random variables
CLO2. Apply the concept of hypothesis testing and apply it to statistical problems.</td></tr>
<tr><td>Skill</td><td>CLO3. Construct a practical problem related to probability and statistics in an analytical form in order to solve it</td></tr>
<tr><td>Attitude</td><td></td></tr>
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<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Introduction to Probability</td><td>1</td><td>I, T</td></tr>
<tr><td>Axiomatic definition</td><td>2</td><td>T, U</td></tr>
<tr><td>Introduction to random variables (RV)</td><td>3</td><td>T, U</td></tr>
<tr><td>Mean, Variance and Higher Moments of a RV</td><td>2</td><td>T, U</td></tr>
<tr><td>Random vectors</td><td>2</td><td>I, T</td></tr>
<tr><td>Introduction to Computer Simulation of Random Variables</td><td>2</td><td>T, U</td></tr>
<tr><td>Fundamental sampling distributions and data descriptions</td><td>2</td><td>T, U</td></tr>
<tr><td>Estimation Problems</td><td>1</td><td>T, U</td></tr>
</table></td></tr>
<tr><td>Examination forms</td><td>Written examination</td></tr>
<tr><td>Study and examination requirements</td><td>Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged.
Assignments/Examination: Students must have more than 50/100 points overall to pass this course.</td></tr>
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Reading list	**Textbook:** [1] Lecture notes **References:** [2] Robert V. Hogg, Elliot A. Tanis and Dale L. Zimmerman, "*Probability and Statistical Inference*", Pearson, 9th Edition, 2015 [3] M. Spiegel et al., "*Theory and problems of probability and Statistics*", Schaum's ouline series, McGraw-Hill Book Company, 3rd Edition, 2009. [4] S. Kay, "*Intuitive Probability and Random Processes Using MATLAB*", Springer, 2006 [5] S. Ross, "*Introduction to Probability models*", Academic Press, 10th Edition, 2010; [6] F.M. Dekking C. Kraaikamp, H.P. Lopuhaa and L.E. Meester "*A Modern Introduction to Probability and Statistics*", Springer, 2005