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| <b>Identification</b>                          | <b>Subject</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>MATH 217</b> Probability Theory and Mathematical Statistics <b>3KU (6 ECTS)</b> |
|                                                | <b>Department</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Mathematics                                                                        |
|                                                | <b>Program</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Undergraduate                                                                      |
|                                                | <b>Term</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Fall, 2026                                                                         |
|                                                | <b>Instructor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Leyla Bayramova                                                                    |
|                                                | <b>E-mail:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | leyla.mustafayeva.96@bk.ru                                                         |
|                                                | <b>Classroom/hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Friday: 11:50-13:20, 13:40-15:10                                                   |
| <b>Prerequisites</b>                           | <b>MATH 101</b> – Calculus - 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                    |
| <b>Language</b>                                | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                    |
| <b>Compulsory/Elective</b>                     | Compulsory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                    |
| <b>Required textbooks and course materials</b> | <ol style="list-style-type: none"> <li>1. “A First Course in Probability” by Sheldon M. Ross, 10th Edition, 2019</li> <li>2. Basic Statistics for Business and Economics, Douglas A. Lind, William G. Marchal, Samuel A. Wathen, Published by McGraw-Hill Education, 9<sup>th</sup> Edition, 2018</li> <li>3. Montgomery, Douglas C., Introduction to Statistical Quality Control (8th ed.), Wiley, New York, 2019.</li> </ol> <p><b>Supplementary book</b></p> <ol style="list-style-type: none"> <li>1. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, John Wiley &amp; Sons, 7<sup>th</sup>, 2018</li> <li>2. Richard Durrett-Probability Theory and Examples 5<sup>th</sup> ed. 2019</li> <li>3. Joseph K. Blitzstein &amp; Jessica Hwang-Introduction to Probability, 2<sup>nd</sup> ed, 2019</li> <li>4. Achim Klenke-Probability theory: A Comprehensive Course, 3<sup>rd</sup> ed, 2020</li> </ol> |                                                                                    |
| <b>Course outline</b>                          | <ul style="list-style-type: none"> <li>• Define principal concepts about probability.</li> <li>• Explain the concepts of a random event.</li> <li>• Formulate theorems about the concept of probability.</li> <li>• Calculate probabilities using Conditional probability, Rule of total probability and Bayes’ theorem.</li> <li>• Apply and interpret the central limit theorem means.</li> <li>• Calculate the sample size required to estimate a population mean and a population proportion given a desired confidence level and margin of error.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                    |
| <b>Course objectives</b>                       | Theme and initial notions of Probability Theory, Probability in discrete sample space, Elements of Combinatorics, Kolmogorov’s axioms, Properties of Probability, Geometrical Probability, Conditional Probability and Independence of events, Total probability and Bayes’ formula, Independent trials, Bernoulli scheme, Random Variables, Discrete and continuous distributions, Mathematical expectation and variance, Sampling Methods and Limit Theorems, Law of large numbers, Elements of mathematical Statistics, Describing Data, Estimation and Confidence Intervals, Linear regression, Hypothesis Testing.                                                                                                                                                                                                                                                                                                                                |                                                                                    |
| <b>Learning outcomes</b>                       | <p>Upon successfully completing this course students will be able to:</p> <ul style="list-style-type: none"> <li>• Express the concepts of factorial and the basic principal of counting.</li> <li>• Calculate the probability of simple events, compound events, complementary events.</li> <li>• Solve the problems about conditional probability and Bayes’ theorem.</li> <li>• Express the features of random variables.</li> <li>• Calculate the expected value, variance and standard deviation of a random variable.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                    |

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|                         | <ul style="list-style-type: none"> <li>• Solve the problems about continuous distributions.</li> <li>• Define central limit theorem problems.</li> <li>• Calculate and interpret confidence Interval.</li> <li>• Conduct and interpret hypothesis tests.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                       |                       |
| <b>Teaching methods</b> | <b>Lecture</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                       | x                     |
|                         | <b>Assisted work</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                       | x                     |
|                         | <b>Assisted lab work</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       | x                     |
|                         | <b>Others</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                       |
| <b>Evaluation</b>       | <b>Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Date/deadlines</b> | <b>Percentage (%)</b> |
|                         | <b>Midterm Exam</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                       | 30                    |
|                         | <b>Class Attendance</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       | 5                     |
|                         | <b>Quizzes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                       | 20 (4 quizzes)        |
|                         | <b>Activity</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       | 5                     |
|                         | <b>Final Exam</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       | 40                    |
|                         | <b>Total</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       | 100                   |
| <b>Policy</b>           | <ul style="list-style-type: none"> <li>▪ <b>Use of Generative AI Tools</b><br/>The use of generative artificial intelligence (GAI) tools is strictly prohibited in this course. The primary aim of the course is to develop students' independent mathematical reasoning, problem-solving skills, and creative thinking. Students are therefore expected to complete all assignments and assessments independently without the use of GAI tools. If it is determined that a student has used generative artificial intelligence (GenAI) tools while completing assignments, one of the following measures may be applied: <ul style="list-style-type: none"> <li>• Issuing an oral or written warning;</li> <li>• Requiring the resubmission of the assignment;</li> <li>• Reducing the grade for the assignment or assigning a zero (0).</li> </ul> </li> <li>• NO CELL PHONES are allowed during lecture and lab sessions. PLEASE turn them off before lecture! (Not silent or vibrating mode). This is a university policy and violators will be reprimanded accordingly.</li> <li>• No late assignments will be accepted without prior arrangement with the instructor for acceptable excuses. Medical and family emergency will be considered on case-by-case basis.</li> <li>• No late homework will be accepted. Homework is to be completed on an individual basis. Students may discuss homework with classmates, but students are responsible for your own work. If students have consulted classmates, please note the individuals name on the top of students' assignment.</li> <li>• Quizzes may be given unannounced throughout the term and will count as one homework. There will be no make-up quizzes.</li> <li>• Students will be divided into groups of 3 individuals for study group sessions and will be assigned some problems to solve together in the class.</li> <li>• No make-up exams. If students miss an exam, a zero score will be assigned to the missed exam.</li> <li>• If students should miss class due to personal emergency or medical reasons, please notify the instructor by email immediately. A doctor's note will be required for make-up work.</li> <li>• Students are responsible for completing the reading assigned from the textbook related to the covered topics and for checking email regularly for important information and announcements related to the course.</li> <li>• University policy on academic honesty concerning exams and individual work will be strictly enforced.</li> <li>• BE ON TIME!</li> </ul> |                       |                       |

| <b>Date/Day<br/>(Tentative)</b> | <b>Topics</b>                                                                                                                     | <b>Textbook/Assignments</b>                      |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| 18.09.26<br>18.09.26            | Probability<br>Sample Space, Events, Probability measure<br>The Fundamental Principle of counting<br>Permutations<br>Combinations | [1] Ch. 1.1, 1.2, 1.3, 1.4, 1.5                  |
| 25.09.26<br>25.09.26            | Probability of Intersection, Union, and<br>Complementary Event Probability and Counting<br>Techniques                             | [1] Ch. 2.1, 2.2,2.3, 2.4, 2.5                   |
| 02.10.26<br>02.10.26            | Conditional Probabilities.<br>Posterior Probabilities: Bayes' Formula<br>Independent Events                                       | [1] Ch. 3.1, 3.2, 3.3, 3.4                       |
| 09.10.26<br>09.10.26            | Random Variables<br>Probability Mass Function and Cumulative<br>Distribution Function                                             | [1] Ch. 4.1, 4.2, 4.3,4.4, 4.5<br>Quiz 1 (5 pts) |
| 16.10.26<br>16.10.26            | Bernoulli Trials and Binomial Distributions<br>The Expected Value and Variance of the Binomial<br>Distribution                    | [1] Ch. 4.6, 4.7, 4.8                            |
| 23.10.26<br>23.10.26            | Continuous Random Variables<br>Normal Distribution<br>Exponential Distribution                                                    | [1] Ch. 5.1,5.2,5.3,5.4,5.5                      |
| 30.10.26<br>30.10.26            | Gamma Distribution<br>Joint Distribution<br>Independent Random Variables                                                          | [1] Ch. 5.6,6.1,6.2                              |
| 06.11.26<br>06.11.26            | Mathematical Expectations and its Properties                                                                                      | [1] Ch. 7.1<br>Quiz 2 (5 pts)                    |
| 13.11.26<br>13.11.26            | <b>Midterm Exam</b><br>Covariance and Correlation Coefficient<br>Limit Theorems of Probability Theory                             | [1] Ch. 7.4,8.1,8.2,8.3,8.4                      |
| 20.11.26<br>20.11.26            | What is Statistics? Introduction                                                                                                  | [1] Ch. 1                                        |
| 27.11.26<br>27.11.26            | Describing Data: Graphic Presentation                                                                                             | [2] Ch. 2                                        |
| 04.12.26<br>04.12.26            | Describing Data:Numerical Measures                                                                                                | [2] Ch. 3<br>Quiz 3 (5 pts)                      |
| 11.12.26<br>11.12.26            | Estimation and Confidence Intervals                                                                                               | [2] Ch. 9                                        |
| 18.12.26<br>18.12.26            | Hypothesis Testing                                                                                                                | [2] Ch. 10                                       |
| 25.12.26<br>25.12.26            | One-Sample Tests of Hypothesis                                                                                                    | [2] Ch. 10<br>Quiz 4 (5 pts)                     |
| <b>TBA</b>                      | <b>FINAL EXAM</b>                                                                                                                 |                                                  |

This syllabus is a guide for the course and any modifications to it will be announced in advance.