TOMSK POLYTECHNIC UNIVERSITY ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

APPROVED BY
Director of Power Engineering School
_____ A.S. Matveev
«30» 06 2020

**Advanced Mathematics**

**Field of Study:** 13.04.02 Electrical Power and Electrical Engineering
**Program name:** "Electric Generation and Transportation"
**Level of Study:** Master Degree Programme
**Year of admission:** 2020
**Semester, year:** 1, 1
**ECTS:** 6
**Total Hours:** 216
**Contact hours:** 72

- **Lectures:** 24
- **Labs:** 0
- **Practical experience:** 48

**Assessment:** exam
**Division:** Division for Power and Electrical Engineering

Head of Division for Power and Electrical Engineering_____ / Ivaschutenko A.S.

Instructor _____ / Yu.N. Isaev

2020

**Advanced Mathematics**

**Course Overview**

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| Course Objectives | To instruct and motivate students for applying the methodological basis in engineering field. It aims on process efficiency improvement with system optimization and automatization of data registering, processing and analyzing. |
| Learning Outcomes | In the course of study students:<br>- dispose themselves for self-improvement and development of their intellectual and general cultural competences, mastering new research methods,<br>- can apply the methodological basis of scientific knowledge in science evolvement and working with the assistance of modern ICT<br>- should be able to demonstrate advanced natural-science and mathematical skills in the context of the interdisciplinary innovative engineering field,<br>- must allot and complete innovative tasks of engineering area, employing deep fundamental and special knowledge, analytical approaches and complex models under the conditions of uncertainly,<br>- must carry out innovative engineering research in the electrical engineering sphere, using world innovation data bases. |
| Course Outline | **Unit 1.** The theory of probability and the statistic theory implementation in reliability evaluation of a system and a device.<br>**Lectures:**<br>1. Probability, Statistics (2 hours);<br>2. Reliability engineering (2 hours);<br>3. Distribution functions of failures (2 hours).<br>**Practice 1.** Reliability prediction of electric equipment (8 hours, including the tests).<br>**Unit 2.** Values relationship approximation.<br>**Lectures:**<br>4. Interpolation (2 hours);<br>5. Regression analysis (2 hours).<br>6. Correlation analysis (2 hours).<br>**Practice 2.** An identification of dynamic system parameters (8 hours, including the tests).<br>**Unit 3.** Spectral analysis<br>**Lectures:**<br>7. Basic concepts of the signal (2 hours);<br>8. Fourier transform (2 hours);<br>9. Continuous spectral transformations (2 hours).<br>**Practice 3. S**pectral analysis of signals (8 hours, including the tests).<br>**Unit 4.** Differential equations<br>**Lectures:**<br>10. Analytical methods for solving ordinary differential equations (2 hours);<br>11. Operational calculus (2 hours);<br>12. Numerical methods for solving linear differential equations (2 hours).<br>**Practice 4.** Dynamic processes of nonlinear systems (8 hours, including the tests). |

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| Prerequisites | Mathematical Analysis, Differential Equation |
| Course Structure | Consider abstract terms and basic definitions in the theory of probability, an event algebra, axioms and properties in the theory of probability, a one-dimensional random variable, properties of a random value distribution function, abstract terms and basic definitions in the reliability theory, a reliability quality specification, the life cycles of technical equipment, the lows of distribution of failures, abstract terms and basic definitions in the statistic theory. Also consider abstract terms in correlation and functional relationship, a correlation and regression analysis, the method of the least squares, the interpolation, abstract terms in the signal theory, spectral analysis of signals. As well as consider basic definitions, the analytical and numerical methods and the method of operators in differential equation solving. |
| Facilities and Equipment | Classrooms for practical works are equipped with computers. Software Mathcad is installed on the computers. |
| Grading Policy | In accordance with TPU rating system we use:<br>Current assessment which performed on a regular basis during the semester by scoring the quality of mastering of theoretical material and the result of practical activities (performance tests, perform tasks, problem solving). Max score for current assessment is 80 points, min – 20 points.<br>Course final assessment (exam) is performed at the end of the semester. Max score for current assessment is 20 points.<br>The final rating is determined by summing the point of the current assessment during the semester and exam scores at the end of the semester. Maximum overall rating corresponds to 100 points, min pass score is 64. |
| Course Policy | - |
| Teaching Aids and Resources | Compulsory Readings:<br>**1.** Kreyszig E. Advanced Engineering Mathematics. — New York: JOHN WILEY & SONS, INC, 2011. — 1280 p. Схема доступа: http://portal.tpu.ru:7777/SHARED/d/...201.pdf<br>**2.** Rice J.A. Mathematical Statistics and Data Analysis. — Belmont: Thomson Brooks/Cole, 2010. — 685 p. Схема доступа: http://portal.tpu.ru:7777/SHARED/d/...Analysis.pdf<br>**3.** Patrick D. T. O'Connor. Practical Reliability Engineering. — New York: JOHN WILEY & SONS, INC, 2012. — 504 p. Схема доступа: http://qpr.buaa.edu.cn/docs/20150408124024767679.pdf<br>**4.** Yang X.S. Engineering Mathematics with Examples and Applications. — London: Academic Press, 2017. — 400 p. Схема доступа: https://www.sciencedirect.com/book/9780128097304/engineering-mathematics-with-examples-and-applications<br><br>Additional Readings:<br>**1.** Maxfield B. Essential Mathcad for Engineering, Science, and Math. — San Diego, California: Academic Press, 2009. – 490 p. Схема доступа: https://www.sciencedirect.com/book/9780123747839/essential-mathcad-for-engineering-science-and-math<br>**2.** Волков Е.А. Численные методы: Учеб. пособие для вузов. – М.: Наука, 1987. – 248 с. Схема доступа: http://portal.tpu.ru:7777/SHARED/d...pdf<br>**3.** Волков Н.Г., Сивков А.А., Сайгаш А.С. Надежность электроснабжения: Учеб. пособие для вузов. – Томск: Изд-во ТПУ, 2011. – 168 с. |

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| | Схема доступа:<br>http://portal.tpu.ru:7777/SHARED/s/SIVKOV/uchebnrab/Tab1/Tutorial.pdf |
| Instructor (-s) | Isaev Yusup Niyazbekovich.<br>E-mail: isaev@tpu.ru |