TOMSK POLYTECHNIC UNIVERSITY ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

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

SYLLABUS FOR

"Statistical Methods in Economics"

Field of study: 13.04.02 "Electric Power and Electrical Engineering"

Program name: "Electric Generation and Transportation"

Level of study: Master

Year of admission: 2019

Semester, year: semester - 3**; 2020.**

ECTS: 4

Total Hours: 144

Contact Hours: 32

- **Lectures:** 8
- **Labs:** 0
- **Practical experience:** 24

Assessment: credit-test

Type of intermediate certification: none

Department: DEPARTMENT OF ELECTRIC POWER AND ELECTRICAL ENGINEERING

Head of department of Electric Power and Electrical Engineering Department _____ Ivaschutenko A.S.

Instructor: _____ Kritsky O.L.

2020

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Statistical Methods in Economics

Course Overview

Course Objectives	The main objectives of the course are: ▪ to provide students with theoretical foundations and methods of theory of statistics; ▪ to provide students with knowledge of typical economic problems and statistical methods for solving them; ▪ to develop practical skills of the statistical methods and theories application to real data sets.
Learning Outcomes	The student must: know: ▪ the main notions, features and stages of analysis of stochastic processes and economic models based on them; ▪ the key notions and methods of the stochastic theory in the context of the Ito's calculations; ▪ the fundamental tasks of the financial mathematic theory and their classical solutions; ▪ theoretical basis of the main methods of stochastic processes integration; ▪ the stages of investigation of statistical connection between the random solution vector components. be able to: ▪ calculate the covariance function of a stochastic process; ▪ apply mathematical methods to the investigation of a random sequence convergence; ▪ use the univariate and bivariate Ito formula and the variable; ▪ calculate stochastic integrals; ▪ solve stochastic differential equations or convert them to mathematical physics equations. possess: 1. the main analytical approaches to the probability and stochastic analysis; 2. the methods of the key characteristics calculations in probability analysis of a practical financial tasks; 3. the mathematical symbolism to describe quantitative and qualitative objects interaction.
Course	Course structure and content: 1. The random process: main notions (4 hours).

Structure	2. Convergence, integration and differentiation of the random processes (3 hours). 3. Solution of the stochastic differential equations (3 hours). 4. Partial derivative differential equations (4 hours). 5. Stochastic volatility models (4 hours). 6. Stochastic interest rates models (4 hours). 7. Credit risk (4 hours). 8. Stochastic obligations (4 hours).
Facilities and Equipment	Computer classes and Internet technologies
Grading Policy	In accordance with TPU rating system we use: -Current assessment which performed on a regular basis during the semester by scoring the quality of mastering of theoretical material and the results of practical activities (test, written tasks, laboratory work). Max score for current assessment is 80 points, min – 55 points. _Course final assessment (credit test) is performed at the end of the semester. Max score for course final assessment is 20 points. Maximum overall rating corresponds to 100 points, min pass score is 55 points.
Teaching Aids and Resources	Compulsory Readings 1. Benth F.E. Option Theory with Stochastic Analysis // An Introduction to Mathematical Finance. – Springer Verlag. –2002. – 168 p. 2. Embrechts P., Kluppelberg C., Mikosh T., Modeling Extreme Events, Springer Verlag, 1997. 3. G. A. Young, R. L. Smith, Essentials of Statistical Inference, Cambridge Series in Statistical and Probabilistic Mathematics, Cambridge University Press, 2005, 236 p. 4. Herman J. Bierens, Introduction to the Mathematical and Statistical Foundations of Econometrics, Cambridge University Press, 2005, 317 p. 5. Hull J. Options, Futures, and Other Derivatives // Prentice-Hall, Saddle River. – New Jersey. – 2003. –755 p. 6. Lando D. Credit Risk Modelling. Princeton, NJ: Princeton University Press, 2004, 312 p. 7. McNeil A.J., Frey R., Embrechts P., Quantitative Risk Management. Concepts, Techniques and Tools // Princeton University Press, Princeton, NJ, 2005. 8. Rachev S.T., Menn C., Fabozzi F.J., Fat–tailed and Skewed Asset Return Distribution. Implications for Risk Management, Portfolio Selection, and Option Pricing, John Wiley & Sons, Hoboken, USA, 2005. 9. Ser–Huang Poon A Practical Guide to Forecasting Financial Market Volatility // John Wiley & Sons. –Chichester, England. – 2005. 10. Wilmott P. Introduces Quantitative Finance. Chichester, West Sussex: John Wiley & Sons Ltd., 2007. 2nd Edition. 696 p. 11. Ajvazyan S.A., Mchitaryan V.S., Applied statistic. Basis of econometrics, Uniti-Dana. – Moscow. – 2001. – Vol.2. – 656 p. 12. Krivilev A.V., Baiss of Matlab. – Leks-kniga, - Moscow. – 2005. – 496 p. 13. Shiryaev A.N., – Basis of stochastic financial mathematics. – Nauka. –

Moscow. – 1998. – Vol 2. – 544 p.
14. Lobanov A.A., Chugunov A.V., et.al., Encyclopedia of the financial risk management. – Alpina. – 2005. – 878 p.

Additional readings

1. A.K. Bera, S. Kim, Testing constancy of correlation and other specifications of the BGARCH model with an application to international equity returns, Journal of Empirical Finance, 2002, 9, pp. 171–195.
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8. Alexander C., Principal component models for generating large GARCH Covariance Matrices, Economic Notes, 2002, V. 31, №2, p. 337-359.
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10. *Barndorff-Nielsen O., Shephard N.*, Measuring the impact of jumps in multivariate price processes using bipower covariation. Working paper, Nuffield College, Oxford University, 2003.
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13. Bollerslev T., Modelling the Coherence in Short-Run Nominal Exchange Rates: A Multivariate Generalized ARCH model, The Review of Economics and Statistics, 1990, V.72, №3, p. 498–505.
14. Bollerslev T., Woolridge J.M., Quasi-Maximum Likelihood Estimation and Inference in Dynamic Models with Time Varying Covariances, Econometric Reviews, 1992, 11, p. 143-172.
15. *Bollerslev T., Tzuo Hann Law, Tauchen G.*, Risk, jumps, and diversification, Journal of Econometrics, 2008, **144**, p. 234-256.
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independent component analysis, Journal of Computational and Applied Mathematics, 2007, 205, p. 594–607.
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