TOMSK POLYTECHNIC UNIVERSITY ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

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

Automation and Emergency control of Power Systems

Field of Study: 13.04.02 Electrical Power Engineering

Programme name: Electric Power Generation and Transportation

Level of Study: Master Degree Program

Year of admission: 2020

Semester, year: 1, 2020

ECTS: 3
Total Hours: 108
Contact Hours: 48
• **Lectures:** 16
• **Labs:** 32
• **Practical experience:** -

Assessment: exam

Department: Department of Electric Power and Electrical Engineering Department

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

Instructor _____ Ruban N.Yu.

2020

Automation and Emergency control of Power Systems

Course Overview

Course Objectives	*The course describes key procedures, devices, and elements crucial to the automation and emergency control of power systems.*
Learning Outcomes	*1. Students will have a competent grasp of the basic principles and theories of the automation and emergency control of power systems.* *2. Students will be able to determine the need to install a specific type of automation.* *3. Students will be able to calculate settings of automation and emergency control devises.*
Course Outline	*Major topics include: Reclosing and Synchronizing; Automatic Transfer Switch; Load-Shedding; Generator Tripping; Steam Turbine Fast Valving; Out-of-Step Protection; Controlled System Separation.*
Prerequisites (if available)	*Electrical power systems and networks; English language competence of CEFR level B1*
Course Structure	*1. Automatic control of the excitation of synchronous machines, control of the modes for voltage and reactive power* *Synchronous generator as a regulated object when solving the problem of excitation control. The main perturbation effects, regulatory impacts. The role of automatic excitation control for the power system in normal and emergency modes. Difference and generality of tasks of excitation and voltage regulation.* *2. Automatic switching of synchronous machines to parallel operation* *Conditions for the parallel operation of synchronous generators. Two ways of switching generators to parallel operation: precise synchronization and self-synchronization. Conditions for precise synchronization of the generator. Principles of automatic selection of the moment when the switching pulse is supplied with precise synchronization. Examples of automatic self-synchronization devices. Areas of application of precise synchronization and self-synchronization. Criteria for choosing the method of synchronization.* *3. Automatic control of frequency and active power in power systems* *Primary speed controllers for powerful modern turbines. Distribution of active power between generators and power plants in power systems. Control of the frequency and active power mode in the interconnected power systems with power flow limitations on power lines. Centralized and decentralized systems for automatic frequency and active power control.* *4. Special automation devices for preventing the occurrence and development of accidents in power systems* *Operating conditions of modern power systems. Consequences of stability violation. Conditional sequence of action of automation devices reducing the probability of accident. Relay protection. Automatic reclosing. Automatic transfer switch. Automatic control of active power to maintain stability, automatic termination of the asynchronous mode, automatic load-shedding, automatic frequency limitation. Out-of-step protection. Static and dynamic characteristics of power systems in case of power shortage. Consequences of frequency deficit in power systems.*
Facilities and Equipment	*Classroom for lecture classes* *Training laboratory for laboratory work:*

	Computer - 10 pcs., Projector - 1 pc., Screen, board
Grading Policy	*In accordance with TPU rating system we use:* *Current assessment which is performed on a regular basis during the semester by scoring the quality of mastering of theoretical material and the results of practical activities (performance tests, perform tasks, problem solving). Max score for current assessment is 80 points, min - 55 points. Course final assessment (exam' credit test) is performed at the end of the semester. Max score for course final assessment is 20 points.* *The final rating is determined by summing the points of the current assessment during the semester and exam (credit test) scores at the end of the semester. Maximum overall rating corresponds to 100 points, min pass score is 55.*
Course Policy	*Class attendance will be taken into consideration when evaluating students' participation in the course*
Teaching Aids and Resources	*1. J. Lewis Blackburn and Thomas J. Domin. Protective Relaying: Principles and Applications, 4-th Edition, CRC Press, ISBN-10: 1439888116, 2014* *2. Walter A. Elmore. Protective Relaying: Theory and Applications, 2 edition, 2003. ISBN-10: 8123910568* *3. Peter M. Curtis. Maintaining Mission Critical Systems in a 24/7 Environment, Wiley-IEEE Press; 1 edition, 2007. ISBN-10: 0471683744* *4. Prabha Kundur. Power System Stability and Control, McGraw-Hill Professional, 1st edition, 1994, ISBN-10: 007035958X*
Instructor	*Nikolay Yu. Ruban* *Office: 8-240; office hours: TBA (and posted) and by Appointment.* *E-mail: rubanny@tpu.ru; phone: +7 (3822) 701-777 / 1914*