



STEAM AND GAS TURBINES UNITS AND ENGINES

MASTER'S PROGRAMME DEGREE



PROGRAM ADVANTAGES

- ✓ According to the statistics for 2020, about 70% of the world's electricity is generated by thermal (TPP) and nuclear (NPP) power plants, where steam and gas turbines convert thermal energy into mechanical energy to rotate an electric generator. Working at TPPs and NPPs, requires the knowledge of theoretical issues related to the operation of steam turbine and gas turbine power plants. In addition, skills and abilities in technical diagnostics, identifying problematic issues, setting urgent tasks, conducting scientific research and technical developments are required.
- ✓ The master's program takes into account modern world requirements for the selection of innovative methods and means of solving the assigned tasks, to ensure that the energy, fuel, economic and environmental parameters of steam and gas turbine plants correspond to the highest indicators in the global turbine construction.
- ✓ Due to the international composition of the academic group, it is possible to compare the features of the operation of steam and gas turbines in different countries and climatic conditions.
- ✓ Training feature – a large number of hours are allocated to research and practice.
- ✓ Specialists from various energy organizations and graduates of the program conduct lectures and master classes.
- ✓ The opportunity to participate in the student exchange program with partner universities.
- ✓ Over the long history, graduates of the program have worked in the energy industries in many countries, including in the construction and operation of nuclear power plants in Russia and the world.



STUDYING PROCCESS

120 educational credits.

Lectures, practical classes, self-study work several types of internship.



MATHEMATICAL MODELING OF THERMAL PROCESSES

- The principles of mathematical modeling.
- Simulation concepts in mechanics.
- Elementary mathematical models.
- Models from the fundamental laws of nature.
- Conservation of the mass of the substance.
- Energy saving.
- Conservation of the number of particles.
- Joint application of several fundamental laws.
- The concepts of gas dynamics.
- Equations of gas dynamics in Lagrangian coordinates.
- The study of mathematical models.
- Application of similarity methods.
- Application of dimensional analysis to the construction of exact particular solutions to problems of mathematical physics.
- Dimension analysis and transformation groups.



COGENERATION PLANTS BASED ON HEAT ENGINES

- Cogeneration, trigeneration.
- Secondary Energy Resources (SER).
- Classification of SER.
- Thermal balance of heat engines.
- Cogeneration complexes based on vocational schools.
- Cogeneration plants based on GTU.
- Cogeneration plants based on ICE.
- Accounting and regulation of energy consumption.
- Heat pump installations.
- Organization and stimulation of energy saving using SER.
- Economic incentive.
- Cogeneration in Russia and abroad.



- Energy planning, energy audit.
- Renewable energy production.
- Hydropower Wind power.
- Solar energy.
- Bioresources.
- Geothermal energy.
- Classification of heat pump units (HPU).
- Characterization of low-grade heat sources.
- Theoretical foundations of steam compression heat pump units (CHNU).
- Ways to improve the efficiency of CHNU.
- Working agents for CTNU.
- Problems of using freons.
- Montreal Protocol, Kyoto Agreement and the Paris Climate Agreement.
- The characteristic of the secondary resources of a heat engine.
- The use of HPU to increase the efficiency of using SER of heat engine.



TURBINE TEST METHODS

- Experimental research types, planning concepts and experimental design, screening out and extreme experiments, reducing the number of variables.
- Probability theory in experimental practice, distribution functions of random variables.
- Variational series, statistical characteristics, variance, errors.
- Analysis of variance, factor analysis, correlation analysis, regression analysis.
- Planned experiment, checking the adequacy of mathematical models.
- Comparison, documentation and presentation of experimental data.
- Test methods for turbines.
- Measurement theory and instrumentation.
- Electrical measuring systems.
- Determination of power.
- Measurement of speed.
- Measurement of pressures.
- Temperature measurement Flow measurement.
- Gas analysis, determination of toxicity.
- Determination of turbine noise and vibration.
- Determination of turbine characteristics.



PATENTING

- International and regional patent systems.
- Legal acts relating to invention.
- Technical creativity.
- Stages of creating new technology.
- The Five Commandments of the Inventor.
- The concept of the invention.
- Patentability criteria.
- Types of objects of inventions.
- Claim.
- Patent for an invention.
- The relationship between the author and the patent holder.
- Use of the invention.
- Patent infringement.
- Other rights of authors and patent holders, including copyright and related rights.
- The unity of invention.
- The definition of the object of the invention.
- Analog and prototype.
- Information Search.
- Drafting search rules.
- Search for a prototype Identification of the criterion of “Novelty.
- Identification of the criterion of “Inventive level”.
- Identification of the criterion of “Industrial applicability”.
- Application for invention.
- Description of the invention.
- Formal and patent examination.
- Chamber of Patent Disputes, types of fees, publication of information about the application, issuance of a title of protection.
- The concept of a utility model.
- Registration and examination of an application for a utility model.
- Ergonomic and aesthetic requirements for products.
- Industrial design (definition, purpose and examination).
- Trademark (definition and purpose and examination).
- Rationalization proposal.
- Making an application for a rationalization proposal.
- Rights of innovators.



VARIABLE OPERATION MODES OF COMBINED CYCLE POWER PLANTS

- Different steam distribution systems.
- Efficiency of the turbine and turbine in variable mode.
- Turbine operation at a sliding initial steam pressure.
- Turbine operation with a sliding initial change in steam temperature.
- Axial forces when changing the flow rate of steam.
- Features of the operation of nuclear power plants in variable modes.
- Evaluation of the reliability of turbine elements when the mode deviates from the calculated one.
- Evaluation of the reliability of turbine elements when the mode deviates from the calculated one.
- Deviation of the initial steam parameters and the temperature of the intermediate superheat.
- Influence of final pressure on turbine power and economy.
- Change in the thermal scheme of the turbine.
- Temperature transitional regimes and their consequences.
- Determination of temperatures and temperature strains in the details of a turbomachine.
- Features of transitional regimes of turbines of nuclear power plants.



SPECIAL CHAPTERS OF OPERATING COMBINED CYCLE POWER PLANTS

- Special issues of operation of installations with SGT.
- Reliability and profitability are the basic principles of operation.
- Variable operating modes of vocational schools and gas turbines.
- The operation of the technical college when changing the parameters of fresh steam and pressure in the condenser, load and speed characteristics of the gas turbine.
- Starting and stopping vocational schools.
- Classification of launches, cold start of non-block and block vocational schools.
- Features of starting a vocational school from a hot and non-cooling state.
- Stop vocational schools.
- Cooling turbine shutdown.
- Vibration of turbo units.
- Basic concepts, types of vibration of a turbine unit: causes, consequences.
- Norms of permissible vibration.
- SGT installations and the environment.



- Models of interaction of plants with SGT with the environment.
- Primary air pollutants.
- Secondary air pollutants.
- Air emissions, the impact of energy facilities on the hydrosphere.
- Thermal impact of energy on the environment.
- Reducing pollutant emissions.
- Wastewater treatment of energy facilities.
- Ways to reduce the impact of installations with SGT on the environment.



SPECIAL CHAPTERS OF THEORY OF HEAT ENGINES

- Thermodynamic justification for the use of ICE pressurization.
- Compressors Turbochargers Modification of the engine using gas turbine boost.
- Starting systems.
- Intake and exhaust manifolds and intercooler.
- Supercharged engine with positive ignition.
- Special boost systems.



HEAT EXCHANGERS

- General information about heat exchangers.
- The main types of heat exchangers.
- Fundamentals of the theory of heat transfer.
- Fundamentals of the calculation of recuperative heat exchangers.
- Resistance to movement of working bodies in recuperators.
- Hydraulic characteristics.
- Improving the efficiency of heat exchangers.
- Basics of calculating regenerative heat exchangers.
- Condensators.
- Heat exchangers for steam gas turbine unit.



STUDENTS FEEDBACK

HASSAN KHALIFE, LEBANON

“ Student at the department of mechanical and instrumentation engineering. This department has become my second home, since I came to Moscow to study in 2013. The program “Power Engineering” provides superb knowledge in several engineering domains, such as, internal combustion engines, steam and gas turbines, renewable energy and others.

The professors at the department are friendly and experienced. Every student gets the same level of attention from the professors to ensure that all of the students understand the subject. Moreover, the professors are always motivating the students and directing them towards high academic achievements. Every year, technical conferences are held in the department, where students present interesting projects that tackle modern engineering problems.

The experience and knowledge achieved at the department of mechanical and instrumentation engineering are more than enough to build a successful career as an engineer, and prove yourself in the power generation sector. I highly recommend the program “Power Engineering” to any student dreaming of making this world a better place, energy wise! ”

ANDRIAN RASAMOELINA M.M.M., MADAGASCAR

“ I am currently doing my master’s degree at the department of mechanical and instrumentation engineering in RUDN university, majoring in “Power engineering”.

I am really glad that I had the chance to study in this department, as the program is quite attractive. The specialty provides broad knowledge in the field of steam and gas turbines.

In the educational process, it is interesting that professional and experienced teachers from the field of power engineering are involved in teaching students. I never get bored of going to class because the subjects are interesting. Teachers in this department are able to explain lectures to students and the presentation of the material is always of high quality, despite the complexity of some subjects. We are taught theoretical parts, and we also conduct lessons in the laboratories, so we have the opportunity to apply the knowledge gained in practice.

To summarize briefly, education in this department is quite interesting and includes both theory and practice. Students become not only knowledgeable, but also keen, experienced in their specialty. ”




STUDENTS FEEDBACK

 **OLUWAKAYODE ABIMBOLA, NIGERIA**



I studied Power Engineering for my Master's program at People's Friendship University of Russia as an International student and I can say it was a very valuable experience. An experience that prepared me intellectually through their outstanding teaching staff, especially my really supportive supervisor and their first-rate learning facilities. Learning in the Engineering Academy happened not only in classrooms and labs, but also out of classrooms, with the diverse student community.

It also helped me build connections around the world and also to meet and connect with fellow students from my country. I made friends with students from different countries, some countries that I had not known before. It was a really great experience because I got to learn a lot about their culture, language and tradition. It was really fun and if not for my Master's program at People's Friendship University of Russia, I would not have been able to experience something as amazing as that.

Lastly, for an international student, I know part of my concern was the cost of living, but with my student card I was able to get things with discounts and transportation was cheap for students with our bus cards. The hostels are good, very affordable and safety was an issue. That being said I highly recommend People's Friendship University of Russia, if you're interested in learning in a stimulating environment that prepares you for the global market. 



HEAD OF THE PROGRAMME

PETR PLATONOVICH OSHCHERPKOV



PhD in Technical Sciences, Associate Professor of the Department of Mechanical Engineering and Instrument Engineering, Head of the Department of Power Engineering.

FIELDS OF SCIENTIFIC INTERESTS:

alternative fuels for internal combustion engines, issues of operation of internal combustion engines in various conditions.

Author of scientific articles in peer-reviewed Russian and foreign scientific journals (Higher Attestation Commission, SCOPUS, Web of Science).

Regularly makes presentations at Russian and international conferences on energy and heat engines. Co-author of the training manual "ICE Systems"