

Moscow Bauman State Technical University



POWER ENGINEERING Faculty **Refrigeration, Cryogenic and Air Condition** department



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**Using of the master preparations in
a direction «the Refrigerating,
cryogenic technics and life-support
systems» CURRICULUM for
training the Electrical engineering
masters**



Programs of direction «the Refrigerating, cryogenic technics and life-support systems»

- **the Refrigerating engineering and technology**
- **the Cryogenic engineering and technology
the Systems of gas liquefaction and
separation and its transportation**
- **the Climatic engineering**
- **The Life-support systems**
- **The Low temperature medical engineering
and technology**



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The variant part of the Cryogenic engineering and technology program permits to specialize in:

- Helium engineering and technology
- Hydrogen engineering and technology
- Oxygen engineering and technology
- Nitrogen engineering and technology
- Rare gases engineering and technology
- Natural gas engineering and technology
- Transport cryogenic systems
- Space cryogenic systems
- **Superconducting systems**
- others



superconductivity



the Electrical
engineering



the Cryogenic
engineering



Time budget, in weeks

Courses	Theoretical training	Examinations	Practical training	Research practical training	State certification according to results	Holidays/Vacations	In total
I	35	6	4			7	52
II	18	3		19	2	10	52
Total:	53	9	4	19	2	17	104



In total 120 credits/units

(4,320 hours) (1 credit/unit - 36 hours)

- ***General scientific cycle:***

25 credits/units (900 hours)

- ***Professional cycle :***

35 credits/units (1,260 hours)

- ***Practical training and research work:***

40 credits/units (1,440 hours)

- ***State certification according to results***

20 credits/units (720 hours)



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General scientific cycle: a base part
7 credits/units **(252 hours)**

- Foreign language :
5 credits/units ***(180 hours)***
- History and philosophy of a science
and engineering
2 credits/units ***(72 hours)***



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General scientific cycle: a variant part
17 credits/units (612 hours)

- Strategic and innovative management :
4 credits/units (144 hours)
- Methods of similarity and mathematical processes modeling (**cryogenics and superconductivity**) :
4 credits/units (144 hours)
- Seminar on foreign special scientific literature (**cryogenics and superconductivity**):
3 credits/units (108 hours)



Disciplines to choose by student (for example)

- Experiment planning, processing and analysis (for superconducting systems):
3 credits/units ***(108 hours)***
- Modern problems of electrical engineering (for superconducting systems) :
3 credits/units ***(108 hours)***



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Professional cycle: a base part

12 credits/units *(432 hours)*

- Special sections of thermodynamics of cryogenic systems (using for superconducting devices):

4 credits/units *(144 hours)*

- Actual problems of cryogenic systems and plants (for superconducting devices):

2 credits/units *(72 hours)*



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Professional cycle: a base part

- The analysis and design of cryogenic systems (using for superconducting devices):
4 credits/units ***(144 hours)***
- Computer gas and hydrodynamics, heat exchange (in cryogenic system of superconducting devices):
2 credits/units ***(72 hours)***



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Professional cycle:variant part

23 credits/units (828 hours)

- Superconducting devices :
4 credits/units (144 hours)
- Safety in extremely situations :
2 credit/unit (72 hours)
- The analysis and design
superconducting devices :
4 credits/units (144 hours)



Professional cycle: variant part

- Superconducting materials :
3 credits/units *(108 hours)*
- Theory of superconductivity:
3 credits/units *(108 hours)*



Disciplines to choose by student (for example)

- Modern superconducting devices :
4 credits/units (144 hours)
- Mathematical modeling of processes in superconducting devices :
3 credits/units (108hours)



Practical training:

- At industrial enterprises
2 credit/unit ***(72 hours)***
- Research and development practical training
4 credits/units ***(144 hours)***
- Scientific and research practical training
4 credits/units ***(144 hours)***
- Student training on teaching methodology
2 credit/unit ***(72 hours)***



Research work

28 credit/unit

(1008 hours)



Superconducting devices :

- Electrical engines
- Electrical generators
- Lines of electrical transfer
- Storage devices of electrical energy
- Magnetic systems for physical research



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The analysis and design of superconducting devices:

- Magnetic fields analysis of superconducting windings
- Temperature interval definition of work for various superconducting devices
- Determination of superconducting wires materials
- Strength analysis of superconducting windings in magnetic fields
- Design of superconducting devices



Theory of superconductivity:

- Superconductors of first, second and third kind
- Theory of Londons, BCSH
Thermodynamics of superconductors
- Element of theory GLAG
- High temperature superconductivity



Superconducting materials :

- Niobium material and other materials working under helium temperatures
- High temperature superconducting materials
- Matrix materials of superconducting wires
- Materials of superconducting devices current leads



Modern superconducting devices :

- Magnetic systems of thermonuclear reactors and charged particles accelerators
- Magnetic bearings
- Tomography devices
- Electronics devices



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Mathematical modeling of processes in superconducting devices :

- Action of mechanical forces upon superconducting windings in magnetic fields
- Propagation of normal (resistanto zone in superconducting wires
- Cooling of superconducting devices
- Electrodynamics and heat stability of superconducting systems
- Distributions of superconducting windings magnetic field



Safety in extremely situations :

- Emergency removal of electrical energy from из superconducting devices
- Emergency removal of gas during transaction of superconducting devices from superconducting state to resistant state
- Safety from magnetic fields, created by superconducting devices