

# Life support systems for circumpolar regions

## Basic information

Duration (ECTS)	360 hours (10 ECTS credits)
Starting date	February, 1
Language of instruction	English level B1 (European Framework for Reference of Communicative Skills)
Entry requirements	BSc or MSc degree in Environmental Sciences or Heat Power Engineering

## Course description

The course "Life support systems for circumpolar regions" is devoted to the principles and mechanisms of life-support systems designed for comfortable living of people with minimal damage to natural and climatic zone.

## Special Features

A large part of Krasnoyarsk region is located in the Arctic zone, what makes it a good testing ground for the implementation of modern environmental monitoring techniques and for use of innovative equipment designed to ensure the reliable operation of life support systems in North regions.

## Course aim

The course aims to introduce the structure, theoretical and technical foundations and principles of functioning of life support systems in Arctic conditions, in accordance with sanitary requirements, construction and technical rules and regulations of operation, taking into account reliability, efficiency, and minimum damage to the environment.

## Course objectives

- to give information about new trends in the improvement of these systems in domestic and foreign practice, to develop the ability to objectively assess energetic advantages and disadvantages of both domestic and foreign life support systems and their elements;
- to provide students with analytical skills in order to manage existing systems and their elements, to develop and implement the necessary changes in their structure for purposes of energy consumption improvement, economic efficiency and energy conservation.

## Learning outcomes

Upon successful completion of this course, a student will be able to:

- formulate the principles of creating the most comfortable conditions for living and work of people;
- operate energy systems of life support in the Northern and Arctic regions;
- differentiate the main aspects of the Arctic region development, based on the application of the most stringent environmental standards using the most effective environmentally-friendly technology;

- apply the principles of energy efficiency, allowing to maintain safe and comfortable accommodation, what will lead to growth of the level of socio-economic development of the Northern regions;
- analyze existing systems and their elements, choose the optimal life support system for the Northern and Arctic territories;
- propose projects for development and implementation of optimal trajectories to maximize resource efficiency, preserve and give to people, living in the Arctic region, a modern livelihoods considering their basic social and cultural needs;
- make an objective assessment of advantages and disadvantages of life support systems and their elements (both domestic and foreign).

### **Outline of the content**

Week	Lectures	Practice Sessions/Assignments	Hours
1,2	Special aspects of the development of the Arctic zone.	Overview of heating systems. Heat transfer fluids used in heating systems. Requirements for heating systems.	36
3-6	Special aspects of heat supply in towns and regions of the Russian Federation. The actual loss and inefficient heating systems.	Heat balance of premises. Heat losses. Consumption of heat for warming of intake air, infiltration in a room.	72
7,8	Ventilation and air-conditioning. Designation and classification.	Heat recovery ventilation emissions. Methods of calculation and selection of main elements of the system.	36
9,10	Drinking water supply system. Wastewater treatment.	A scheme of intakes. A common scheme of a water treatment station.	54
11,12	Use of renewable energy sources for heat supply of cities and urban settlements.	Thermal accumulation for solar heating and cooling. Thermal regime of crust. Underground thermal water.	54
13,14	Waste production and methods of its use for production of thermal energy.	Use of secondary energy resources to produce thermal energy.	54
15,16	Technological, technical, economic and environmental requirements for the processes of heat generation.	The main characteristics of solid waste. Methods of extraction of useful products from solid waste.	36
17,18	Energy audit of housing objects and communal services.	The final class.	18

### **Course assessment**

By the end of the course students should pass an exam.

### **Attendance policy**

Organization of individual studies is performed in accordance with the schedule of the educational process. Recommended literature should be studied in order to

handle the topics listed above. Assignments given after lectures are used for the monitoring of the educational process.

**Contact information**

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