MINISTRY OF EDUCATION AND SCIENCE
REPUBLIC OF KAZAKHSTAN

SATBAYEV UNIVERSITY

«CLAIM»
Director Of IAIS
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Head of the ESIS Department
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"08" 01 2020 g.

The SYLLABUS

HUD 1452 " Heating »

for the specialty 5B075200 - " Engineering systems and networks»

3 credits (2/0/1)

Semester: 2nd semester, 2019-2020 academic year

Almaty, 2020

MINISTRY OF EDUCATION AND SCIENCE
REPUBLIC OF KAZAKHSTAN

Institute of Architecture and construction. T. K. Basenova
Department of Engineering systems and networks»

1.Information about teachers:
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* The syllabus is based on the materials of Nurpeisova K. M. and Vetlugina G. A.

1.1.The purpose of the course: students acquire theoretical knowledge and practical skills on the basics of design, construction, installation and operation of heating systems.
2.The purpose of teaching the discipline is to form a set of knowledge and skills on methods of calculating building heating systems, and their application in practical work in solving energy saving issues.
3.Course description:
In the course of studying the discipline, future specialists will study modern methods of designing heating systems for buildings and structures.

Knowledge gained during the course of the course:
As a result of studying the discipline, students should
Know: sanitary and hygienic, technological bases of heating; types and characteristics of heating systems; features of drawing up the heat and air balance of the room during heating; types and characteristics of heating equipment; methods of calculation of pipelines and modern equipment of heating systems.
Be able to: apply theoretical knowledge and skills in practice; determine the power of the heating system; use methods of hydraulic calculations of systems; determine the area of the heating surface of heating devices; design heating systems usingmodern equipment and technologies; carry out reconstruction, testing, commissioning and operation of heating systems.

4.**Prerequisites**: the program of this discipline is based on the disciplines "Physics", "Matematika1", "Matematika2", "Construction Thermophysics"., "Heat generating plants".

.**Post-requirements:** specialized disciplines of the specialty 5B075200 - " Engineering systems and networks

5.List of references:

Basic literature	Additional literature
[1] Сканави А.Н., Махов Л.М. Отопление. М.: Издательство АСВ, 2002. -576с	[8]. Крупнов Б.А. Отопительные приборы производимые в России и ближнем зарубежье. М.: Из-во АСВ, 2005. -96с..
[2] Богословский В.Н., Сканави А.Н. Отопление. Учеб. для вузов. М.: Стройиздат, 1991. -736 с.	[9] Андреевский А.К. Отопление.- Минск.: Вышэйшая школа.,1974.- 432с.
Additional literature	[10]. Сканави А.Н. Конструирование и расчет систем водяного и воздушного отопления здания. М.: Стройиздат, 1983.- 304 с.
	[11]..СНиП РК 2.04.01-2001 Строительная климатология. Астана: Комитет по делам строительства МЭиТ, 2002. –113с.
[3] Сканави А.Н., Богословский В.Н., и др. Отопление и вентиляция. Уч. для вузов.В 2-х частях.Ч1. Отопление. М.: Стройиздат, 1975.-480с.	[14]. СНиП РК 4.02-42-2006. Отопление, вентиляция и кондиционирование. Комитет по делам строительства и ЖКХ МИиТРК, 2007. -53с.
[4]. Дроздов В.Ф. Отопление и вентиляция. Ч1. Отопление. Учеб. для строительных вузов. М.: Высш. школа, 1976. -280 с.	[12]. СН РК 2.04.-21-2004. Энергопотребление и тепловая защита зданий. Астана: Комитет по делам строительства и ЖКХ МИиТ РК, 2004. – 40с.
[5] Андреевский А.К. Отопление.- Минск.: Вышэйшая школа.,1974.- 432с.	[13].СН РК 4.02-17-2005. Проектирование тепловых пунктов. Астана: Комитет по делам строительства и ЖКХ МИиТ РК, 2005. –79с.
[6].Справочник проектировщика. Внутренние санитарно-технические устройства. Ч.1. Отопление. Под ред. И.Г.Староверова, Ю.И.Шиллера. 4-е изд. перераб. и доп. - М.: Стройиздат, 1990. - 344с.	
[7].Крупнов Б.А. Шарафадинов Н.С. Руководство по проектированию систем отопления, вентиляции и кондиционирования воздуха. М.Вена: 2006.-216с.	

MINISTRY OF EDUCATION AND SCIENCE
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6.Calendar and thematic plan:

A week	Lecture topic work	Practical topic	Link for literature	The task
1	Introduction General information about heating.	**Characteristics of the external building envelope**. Rules for measuring the external enclosing structures of the corner and middle rooms of the building. Features measuring the size of the floor of the premises.	L .: Osn. 1 [7-16;], 2 [5-15]; Add. 3 [3-12], 5 [5-12], 12 [94-99], 15 [3-6]. Ex .: main 1 [32-36]; 2 [87-106]; Additional 3 [64-72], 4 [28-29], 6 [34-41], 7 [68-73].	
2	Characteristics of heating systems	Estimated heat loss of the room through the external fencing. The methodology for calculating the main and additional heat loss by the premises	L .: Osn. 1 [17-29], 2 [16-31]; add 3. [13-25], 6 [27-33, 75-80], 15 [9-10]. Pr main 1 [31-43], 2 [87-107]; add. 3 [64-66], 4 [30, 34-36], L .: Osn. 2 [62-72]; add.6 [8-10], 7 [69-72], 12 [26-40], 16 [Clause 5]. Ex .: main 1 [55-59, 115-120], 2 [159-165];	SRS -1 1. Pipelines of the heating system. The use of metal-plastic pipelines. Compensation of thermal elongation and slope of pipelines. Thermal insulation of pipelines. Distribution nodes, fittings and fittings in modern heating systems. L .: [7] p. 15-18
3	Thermal conditions of a heated building	Drawing up a heat balance. Determination of the heat balance of the premises and calculation of the power of the building	L .: Osn. 2 [62-72]; add.6 [8-10], 7 [69-72], 12 [26-40], 16 [Clause 5].	Change SRS 1 Task SRS -2 Types of mixing pumps.

		heating system. Choosing a heating system and locating a local heating center. Calculation of heating devices of a two-pipe water heating system.	Ex .: main 1 [55-59, 115-120], 2 [159-165]; Add. 3 [78-81, 83-86], 4 [73-81, 88-89],	Mixing pump, switching circuit and its functions. Pressure change in the heating system at different pump locations. Automatic regulation of the heating system with a mixing plant.
4	Thermal power system heating	Calculation of circulation pressure in a water heating system. Determination of flow and temperature of water in the riser. Hydrostatic pressure in the riser. Features of hydraulic calculation of water heating systems with natural circulation.	L .: Osn. 1 [32-36.39-43, 46-48]; 2 [87-106,109-114]; add. 3 [67-76, 79-81], 6 [34-41], 7 [68-73]. Etc. main 1 [274-277], 2 [378-383]; add. 3 [198-202], 4 [50-57, 96-103],	Change SRS 2 Task SRS -3 Types of circulation pumps. Circulation pump and pressure generated by the pump unit. Types of circulation pumps and their selection. Scheme of pump connection to pipelines. Features of work and place of installation. L .: [7] p. 22 -23
5	Pipelines and fittings of the heating system	Hydraulic calculation of a two-pipe water heating system. Determination of water consumption by design sections of the system and pipeline diameters. Determination of pressure loss in friction pipelines	L .: Osn. 1 [127161], 2 [173-213]; add. 3 [133-159], 6 [81-83], 7 [74-76], 12 [183-186]. Ex .: main 1 [234-238], 2 [332-337]; Add. 3 [226-229], 4 [89-91], 6 [93-95],	Quiz Change SRS 3 Task CPC-4 Hydraulic calculation of a water heating system. Features of the hydraulic calculation of the heating system with deadlock and associated

				movement of water in the highways.
6	Heating appliances	Calculation of local resistance coefficients. Methods for calculating the coefficients of local resistance for various schemes of heating systems. Methods for linking pressure losses in the circulation rings of a two-pipe water heating system.	L .: Osn. 1 [85-103]; 2 [123 - 144]; add. 3 [87-121], 4 [65-66, 88-89] Ex .: main 1 [231-232], 2 [327-328]; add. 3 [229-233], 4 [91-92, 112, 114],	Change SRS 4 Assignment SRS -5 Features of the calculation of a single pipe system. The coefficients of hydraulic friction and local resistance at a low speed of water flow in pipelines. Thermal calculation of pipelines. One-pipe water heating system with thermosiphon heating devices. L .: [7] p. 28-30
7	Thermal calculation of heating appliances	Calculation and selection of a water-jet elevator of a local heat point. Determination of the mixing ratio	L .: Main 1 [115-120], 2 [159-165]; add. 3 [122-133], 4 [72-81], 6 [46-71]. Ex .: main 1 [75-78], 2 [244-248]; add. 3 [170-172], 11 [131-136].	Quiz Change SRS 5 Task SRS-6 Hydraulic calculation of a steam heating system. Hydraulic calculation of low pressure steam lines. Self-flowing, pressure head condensate pipelines. Features hydraulic calculation of high pressure steam pipelines. L .: [7] p. 57 -61

8	Schemes and characteristics of water heating systems	Calculation and selection of a water-jet elevator of a local heat point. Determining the diameter of the nozzle of a water-jet elevator.	L .: Main 1 [171-175], 2 [159-165]; add. 3 [198-210], 4 [96-103], 6 [88-189], Ex .: main 1 [75-78], 2 [244-248]; add. 3 [170-172], 11 [131-136].	Test questions
9	Calculation of pressure in a water heating system	Calculation and selection of a water-jet elevator of a local heat point Selection of equipment, development of specifications for the heating system.	L .: [9] Dos. 1 [52-53, 78-84], 2 [159-165]; add. 3 [150-156], 6 [87-88]. Ex .: main 1 [75-78], 2 [244-248]; add. 3 [170-172], 11 [131-136].	Change SRS-6
10	The main provisions and methods of calculating heating systems	1.Determine the dew point for air having a temperature of 19 ° C with a relative humidity of φ = 70%. 2.At a temperature of 18 ° C, the air has a relative humidity of φ = 60%. How the relative humidity of the air will change: a) when its temperature rises to 22 ° C; b) when its temperature drops to 15 ° C?	L .: Osn. 1 [228-233;], 2 [324-332]; Add. 4 [89-96], 3 [226-229, 250-252] Ex .: [7] p. 130	Change SRS-7
11	. Hydraulic calculation of a water heating system.	Check the possibility of condensation of water vapor on the inner surface of the fence at tv = 18 ° C, tn = -30 ° C, Ro = 1,156, φ = 58%.	L .: Osn. 1 [234 - 255]; 2 [332 - 337]; add. 3 [229-233], 4 [110-118] Ex: [7] p. 136	

12	Features of the calculation of a single pipe heating system.	It is required to calculate the resistance to vapor permeation of the outer wall of a residential building from small-sized gas silicate blocks, the design of which is shown in for climatic conditions of Atyrau region.	Л.: Осн. 1 [272-274]; 2 [356-362, 363-366,373]; доп. 6[108-115], 11 [121-126]. Пр.: **[7] с. 142-144**	
13	Equipment of the heating station and their selection	Calculate the humidity regime of a wall of light concrete (on blast-furnace granular slag) 50 cm thick (density 1300 kg / m3; λ = 0.58 W / (m2 · ° C); μ = 0.09 mg / (m · h · Pa)) at a temperature of indoor air in the room tv = 18 ° C, humidity φv = 55%. Outside air has a temperature tн = - 10.2 ° C and φн = 86%. Analyze whether there will be condensation of water vapor, as well as changes in the relative elasticity of water vapor and the humidity of concrete in the wall.	L .: Osn. 1 [52-78]; 2 [213-247]; add. 4 [61-64], 11 [131-136]. Ex: [7] p. 149-150	
14	Air heating. Panel radiant heating	Calculate the change in the value of the partial pressure of water vapor (e) depending on the temperature tn = - 10.2 ° C and relative humidity φn = 86%.	L .: Osn. 1 [314-325]; 2 [325-430; 434-438]; add. 3 [319-332,346-348] 4 [197-199]; DOS 1 [359-375; 396-398]; 2 [478-483, 494-499, 523-525]; add. 3 [353-355, 363-373, 384-386]; 4 [182-194], Ex .: [7] p. 150-151	

15			Test questions	
			A written exam	

* The calendar - subject calendar may change subject to holidays

First Interim Certification
1. Is the working area called?
A) part of the room from the floor surface to 2 m mark
B) part of the room above 2 m mark from the floor surface
C) part of the room outside 2 m from the surface of the walls
D) the whole working area
E) part of the room outside 2 m from the surface of the windows

2. The first condition of comfort gives the optimal combination:
A) air temperature and surface radiation temperature
B) temperature and air mobility
C) air mobility and humidity
D) air mobility E) temperature and relative humidity
E) emperature and relative humidity

3. The second condition of comfort gives the optimal combination:
A) temperature limits for heated, chilled surfaces
B) room temperature
C) optimal humidity and air mobility
D) temperature in the working area E) optimal temperature and mobility
E) optimal temperature and mobility

4 The standardized temperature difference for floors is:
A) 2-2.50°C
B) 6-120°C
C) 0-10°C
D) 0-40°C
E) 4-50 °C
5. When 350°C. $\varphi_в$ = 40%, a person loses heat:
A) by evaporation
B) convection
C) radiation
D) by reducing the speed of blood in the vessels
E) thermal conductivity

6.In a high-rise building, is the greatest infiltration through windows?
A) does not depend on the number of storeys
B) on the middle floor
C) on the top floor
D) on the ground floor E) no window infiltration

7. Indoor air mobility affects:
A) convection heat transfer
B) human heat transfer by evaporation
C) heat transfer by radiation
D) thermal conductivity
E) heat transfer by evaporation and radiation

8. The normalized temperature difference tv - tpov is specified from the conditions:
A) sanitary
B) constructive
C) architectural planning
D) economic
E) technical and economic

9 . What indicator is characterized by the coefficient of thermal conductivity:
A) λ
C) Δ
C) τ
D) k
E) R

10. The calculated air temperature in winter will be the highest:
A) for Shymkent
B) for Almaty
C) for Astana
D) for Atyrau
E) for Pavlodar

11. Indicate the formula for determining the thermal inertia D:
A) D = ∑R • S
C) Di = 1
C) Di> 1
D) Di <1
E) D = U • K

12. The thermal inertia of the fence characterizes:
A) measure of thermal stability of the fence
B) a measure of resistance to heat transfer
C) the proportion of heat accumulated in the fence
D) the proportion of heat penetrating the fence
E) heat absorption of the layers of fencing

13. The calculation of the thermal stability of the fence in the winter is reduced to the determination of:
A) the amplitude of fluctuations in air temperature in a heated room
B) thermal resistance of the fence
C) calculation of heat flow through the fence
D) heat transfer coefficient of the layers of the fence
E) the coefficient of thermal conductivity of the layers

14. Heat receipts from lighting during the day are taken into account in the calculations:
A) only from 19 to 24 in the evening and from 6 to 8 o'clock in the morning
C) constantly
C) do not take into account
D) at night
E) from 9 a.m. to 12 p.m.

15. The intensity of solar radiation is taken into account in the calculations:
A) in the summer during June.
C) in winter
C) in spring
D) per hour of maximum revenue
E) in the summer by the hour

Test questions
Second final certification
1. The reason for filtering air through the fence is:
A) wind pressure and gravity pressure difference
B) partial pressure difference
C) temperature difference
D) lack of plaster on the surface of the outer fence
E) no filtering through the outer fences

2. Relative humidity is called:
A) the ratio of the mass of water vapor to the unit mass of dry air
C) the amount of moisture in grams contained in 1m3 of air
C) moisture condensation process
D) the degree of saturation of moist air with water vapor
E) moisture absorption in g / kg from ambient air

3. The most probable area of condensation in the enclosure:
A) in the corners of the outer walls of buildings
C) the inner surface of the insulation layer
C) the outer surface of the inner layer
D) the joint of the factor inner layer and insulation
E) the joint of the insulation and the outer dense in the insulation layer

4. The main reason for wetting the fence is:
A) vapor diffusion through the enclosure from the room to the outside
B) precipitation
C) ground moisture
D) vapor permeation of insulation
E) vapor diffusion through the fence from the outside to the inside of the room

5. The purpose of calculating air permeability is to:
A) complete elimination of air filtration through the fence
B) increase in air permeability to standard
C) increasing the pressure drop to the standard
D) determination of sealant material
E) limiting the amount of air entering through the fence

6. In winter, with a decrease in air infiltration, the power of the heating system:
A) should be reduced
B) should be increased
C) remains unchanged
D) shall be equal to the rated power E) should be equal to the power at an average temperature of the heating period

7. In winter, with a decrease in air infiltration, the power of the heating system:
A) should be reduced
B) should be increased
C) remains unchanged
D) shall be equal to the rated power
E) should be equal to the power at an average temperature of the heating period

8. The total cooling capacity in public buildings consists of heat:
A) from people, solar radiation, through coating, from lighting, equipment
B) from people
C) from solar radiation
D) from electricity equipment, not during working hours
E) from daytime lighting

9. The heat loss of the building will be greatest at an outdoor temperature equal to:
A) absolute minimum outside temperature
B) the outside temperature of the coldest five days
C) the temperature in the month of January
D) average annual outdoor temperature
E) the average temperature of the optimal period
10. Through a window in the shade, heat is transferred:
A) diffuse and reflected radiation
C) direct radiation
C) heat is not transferred
D) ultraviolet rays
E) electromagnetic waves

11. Solar radiation is electromagnetic radiation:
A) shortwave
B) long-wave
C) thermal
D) ultraviolet
E) infrared.

12. The radiation temperature in the room is used for:
A) estimates of the level of thermal comfort
B) calculation of convective heat transfer of a person with a room
C) determining the optimum room temperature
D) definitions II conditions of human comfort in the room
E) convective heat exchange of the heating panel with the surfaces of the room

13. Relative humidity is:
A) the degree of saturation of air with moisture C) partial pressure of steam in the air
B) weight percentage of moisture in the air
D) the fraction of the mass of dry air
E) the partial pressure of saturated vapor in the air

14. Condensation is a process.
A) the transition of steam into liquid
C) the transition of liquid into steam
C) increasing steam pressure
D) reducing vapor pressure
E) liquid crystallization

7. Tasks and brief guidelines for their implementation:
Study the following topics of the CDS and prepare an essay using basic and additional literature

№	Tasks	Methodical recommendations	Literature
1	2	3	4
1	Heating system piping.	Compensation of thermal elongation and slope of pipelines. Thermal insulation of pipelines. Distribution nodes, fittings and fittings in modern heating systems.	Osn.. 1 [127-161], 2 [173-212]; additional 3 [133-135, 139-159]
2	Types of mixing pumps.	Mixing pump, switching circuit and its functions. Pressure change in the heating system at different pump locations. Automatic regulation of the heating system with a mixing plant.	Osn.. 1 [72-77], 2 [240-248]; additional . 3 [166-172], 6 [315-337].
3	Types of circulation pumps.	Circulation pump and pressure generated by the pump unit. Types of circulation pumps and their selection. Scheme of pump connection to pipelines. Features of	Osn... 1 [65-72], 2 [232-240];

		work and place of installation.	additiona.3 [163-166], 6 [315-337].
4	Hydraulic calculation of a water heating system.	Features of the hydraulic calculation of the heating system with deadlock and associated movement of water in the highways.	Osn.. 1 [255-270], 2 [356-373]; add. 3 [277-280], 4 [127-130], 6 [108-114], 12 [239].
5	Features of the calculation of a single pipe system .	The coefficients of hydraulic friction and local resistance at a low speed of water flow in pipelines. Thermal calculation of pipelines. One-pipe water heating system with thermosiphon heating devices.	Osn.. 1 [272-274], 2 [375-378]; add. 3 [261-270], 4 [118-126], 6 [102-108].
6	Hydraulic calculation of a steam heating system	Hydraulic calculation of low pressure steam lines. Self-flowing, pressure head condensate pipelines. Features of the hydraulic calculation of high pressure steam pipelines.	Osn 1 [297-301], 2 [404-415]; add. 3 [301-308], 4 [176-181], 5 [268-315],
7	Equipment for steam heating systems.	Condensate tank. Condensate pumps, selection and installation rules. Throttle washers. Safety and pressure reducing valves. Hydraulic locks, steam traps their principle of operation.	Osn 1 [287-293], 2 [394-402]; add.. 3 [310-315], 4 [172-175],

Independent work of bachelors under the guidance of teachers (SRMP)

1. The calculated heat loss of the room through the surface of the floor of the room.
The method of calculating heat loss through the floor surface of various designs. Features of calculating heat loss through the surface of the floor located above the basement

2.Thermal conditions indoor
Heat in the premises. Specific thermal characteristic and estimated heat consumption for building heating.

3. **Development and selection of a centralized heating system.**
Rules for designing a heating system in buildings, taking into account structures. Elections of the heating system during the reconstruction of the building. Features of designing a heating system for industrial buildings.

4. Development and selection of a local heating system. Rules for designing a heating system in residential buildings. Autonomous boiler rooms for one building and the choice of basic equipment.

5**. Calculation of heating devices from smooth pipes.** The method of thermal calculation of heatingdevices in a two-pipe heating system. Areas of application for heating appliances made of smooth pipes.

6. **Thermal analysis of stamped steel radiators and convectors.** Determination of thermotechnical characteristics of devices. Determination of the estimated area of the heating surface.

7. Calculation of heating devices for single-pipe systems.
The peculiarity of the thermal calculation of the surface of heating devices in a single-pipe heating system. Schemes of **instrumentation with the installation of temperature controllers.**

8.Hydraulic calculation of a single pipe water heating system.
Features of the hydraulic calculation of a single-pipe heating system. Vertical and horizontal single pipe heating systems. Methods for linking pressure losses in the circulation rings of a single-pipe heating system.

9.Regulation and reliability of central heating systems.
The tasks of regulation. Types and places of regulation. Manual and automatic regulation of water heating systems. Features of regulation of various heating systems.
10. **Reliability of heating systems.** The concept of reliability. The efficiency of the heating system in case of violation of the structure and deviation of the coolant parameters from the calculated ones. Providing hydraulic and thermal modes of the heating system during commissioning.
11. Reconstruction of the heating system. Depreciation and system life. Reconstruction while reducing pipe throughput, changing the type of coolant, rebuilding the building, changing production technology. **Reconstruction to save thermal energy.**
12. Steam heating systems.
Classification of steam heating systems. Schemes of steam heating systems. Advantages, disadvantages and scope. Features of calculating the area of the heating surface of heating appliances.
13. Steam heating systems.
Condensate return. Types of condensate pipelines. Removing air from the system. Selection of initial vapor pressure in closed and open systems. Steam-water heating system.
14. Improving heating systems.
Reconstruction of the heating system. Methods of increased thermal stability of a two-pipe heating system. Combined heating systems, two-mode and two-component with intermittent mode.
15. Underfloor heating.
Appointments of underfloor heating. The study of the device and installation of underfloor heating. Schemes of accession. Application of the heating principle for other purposes.

Schedule for completion of required work

No. p / p	Types of control	Max point of the week	Weeks															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total Max Points
1	Activity in lecture discussions	0,5		0,5	0,5	1,0	0,5	0,5	1,0		0,5	0,5	1,0	0,5	0,5	1,0		8
2	Activity in practical classes	0,5		0,5	0,5	1,0	0,5	0,5	1,0		0,5	0,5	1,0	0,5	0,5	1,0		8
3	Implementation of practical tasks (SRSP)	1,0		1,5		1,5		1,5			1,5		1,5		1,5			9
4	The performance of laboratory tasks																	
5	Individual project work	2,0					2,0									2,0		4
6	1st intermediate certification (Midterm)	10,0								10								10
7	Independent work of a student (SRS)	1,5		1,5		1,5		1,5			1,5		1,5		1,5		2,0	11
8	2nd final certification (Endterm)	10,0															10	10
	Final exam	40															40	40
	Total amount			4	2	5	3	4	2	10	4	2	5	3	4	2	50	100

Description of classes:

Activity in lectures and practical classes is mandatory and is one of the components of Your final score / assessment. Many theoretical questions that support the lecture material will be presented only in lectures. Therefore, skipping a class can affect your performance and final grade. Every two delays and / or departures before the end of the class for any reason will be counted as one missed session.However, attending classes in itself does not mean an increase in points. We need your constant active participation in the classes. A mandatory requirement of the course is to prepare for each lesson.

It is necessary to view the specified sections of the textbook and additional material not only in preparation for practical classes, but also before attending the corresponding lecture. This training will facilitate your perception of new material and will contribute to your active acquisition of knowledge at the University.

Practical tasks (SRSP) are an independent solution of problems on the passed topic under the guidance of a teacher. Tasks will be presented during practical sessions. They are mandatory for all students to complete as a current independent work. When preparing your homework, you should use the knowledge you have learned from textbooks and classes. Based on the work you completed, the average score will be displayed. The timeliness of completion and delivery of tasks will be taken into account.

Laboratory tasks are the development and preparation of programs for solving specific tasks. Tasks will be presented on the site in the portal. The tasks are executed in an appropriate way and include the use of the necessary literature. The timeliness of work completion and delivery will be taken into account.

Course design work-performed by You alone or as part of a group of students from 3-4 people. Project topics are determined by you in consultation with the teacher and approved together with the names of students in Your mini-group. During the set time period, you should regularly discuss the project process with each other and with the teacher, according to the deadlines provided in the calendar and thematic plan, and submit the relevant parts of the project to him during his office hours.Group projects will be defended in front of all students during the last week of classes and should not exceed 10 minutes of presentation time. The evaluation received for the project is distributed to all members of the group. Additional requirements for project execution and the project delivery plan will be discussed during office hours.

Independent work of the student (semester tasks) provides for the completion of 7 tasks during the semester, covering the passed material of the discipline. Tasks must be completed in writing and submitted as they are completed according to the deadlines. Based on your written work, the average score will be displayed. The timeliness of work completion and delivery will be taken into account.

The final exam covers and summarizes all course material. The exam is conducted in writing and covers different types of tasks: written questions covering the passed lecture material, practical solution of a specific problem. The duration of the exam is 2 academic hours. No additional tasks for the exam to improve the score if it is low, will not be issued. There will also be no retaking of the exam.

1. Criteria for evaluating work:

Rating by letter system	**The digital equivalent of aluation**	**Criterion**
A	**95 – 100**	the student answered freely, with a deep knowledge of the material, he correctly and fully solved the situational problem (completed all the tasks, correctly answered all the questions posed)
A -	**90 – 94**	the student answered freely, with a deep knowledge of the material, he correctly and fully solved the situational problem with insignificant
B +	**85 – 89**	the student answered quite convincingly, with minor errors in theoretical preparation and sufficiently mastered skills, essentially answered the questions correctly or made small errors in the answer
B	**80 – 84**	

		the student answered quite convincingly, with minor errors in theoretical preparation and sufficiently mastered skills, essentially answered the questions correctly and made 3 errors in the answer
B -	**75 – 79**	the student answered quite convincingly, with minor errors in theoretical preparation and sufficiently mastered skills, he essentially answered the questions correctly and made 5 errors in the answer
C +	**70 – 74**	the student did not answer confidently enough, with significant errors in theoretical preparation and poorly mastered skills answered questions of the situational problem
C	**65 – 69**	the student answered insufficiently confidently in theoretical preparation and poorly studied
C -	**60 – 64**	the student did not answer confidently enough, with significant 3 errors in theoretical preparation and poorly mastered skills answered questions of a situational task; with difficulties, but still can, if necessary, solve a similar
D +	**55 – 59**	the student answered insufficiently confidently, with significant 5 errors in theoretical preparation and poorly mastered skills answered questions of a situational
D	**50 – 54**	the student answered insufficiently confidently, with significant 7 errors in theoretical preparation and poorly mastered skills, answered with difficulty the questions of the situational problem
F	**0 – 49**	if the student has a very poor understanding of the subject and made significant mistakes in answering most of the questions of the situational problem, incorrectly answered the questions asked additionally, cannot cope with the solution of such a problem in practice

* It is possible to receive bonus points for completing additional tasks

Grading Policy:

At the end of the semester, you receive a general final grade, which is a common indicator of your work throughout the semester. The final grade will be set in accordance with the grading scale adopted by KazNITU.

Evaluation criteria for practical and laboratory work: completeness of the solution to the problem, accuracy of calculations and timely delivery.
Evaluation criteria for coursework design work (group project): creativity of the project decision, originality of the solution is different from the existing ones, accuracy of calculation, presentability and communication skills on defense.
Criteria for exams: correctness and completeness of answers, accuracy and accuracy of presentation.
1. The course policy includes the following requirements:
The student must come prepared for lecture, practical and laboratory classes. Timely protection of laboratory work, the full implementation of all types of work (practical, laboratory and independent) is required. The student should not be late and miss classes, be punctual and compulsory. It is planned to reduce the maximum score by 10% for untimely completed work.

If you are forced to skip the midterm exam for valid reasons, you must notify the instructor before the exam. After writing an exam by all students and analyzing it in class, the exam can be passed. Skipping an exam for a disrespectful reason deprives you of the right to pass it.

1. The policy of academic conduct and ethics:

Be tolerant, respect the opinions of others. Formulate objections in the correct form. Plagiarism and other forms of dishonest work are unacceptable. It is unacceptable prompting and cheating during exams, passing the exam for another student. A student found to falsify any course information will receive a final grade of "F".

Help: For advice on the implementation of independent work, their delivery and protection, as well as for additional information on the material covered and all other questions that arise regarding the course being taught, please contact the teacher during his office hours or through electronic communications around the clock.

Fighting corruption: intransigence to corruption.

Considered at a meeting of the department "Engineering systems and networks", protocol No. 7 dated January 08, 2020