Ministry of Education and Science of Ukraine
Sumy National Agrarian University
Faculty of Engineering and Technology
Department of food technology

# Work program (syllabus) of the educational component

## SC 5 Energy management and energy audit of processing and food enterprises

It is implemented within the educational program
**Food technologies**
in specialty 181 "Food technologies"

at the second (master's) level of higher education

Sumy - 2022

**Developer: __**  **____ Savchenko-Pererva M.Yu.,**Ph.D., Associate Professor of the Department of Food Technology

(signature) (surname, initials) (degree and title, position)

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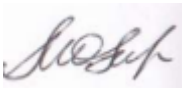
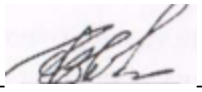
|---|---|
| Considered, approved and approved at the meeting of the department of food technology | Protocol from 14 June 2022 No 18 |
| | Head department  _____ (signature) |

**Agreed:**

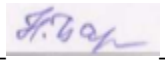
Guarantor of the educational program _____  _____
(signature) (surname)

Dean of the faculty where the educational program is implemented _____
(surname)

Review of the work program (attached) provided: Melnyk O.Yu. 
(surname)

Stepanova T.M.
(surname)

Methodist of the Education Quality Department,

licensing and accreditation_____  _____ (N. Baranik___)
(signature) (surname)

Registered in the electronic database: date: _____05.07._____2022.

Information on viewing the work program (syllabus):

| The academic year in which the changes are made | The number of the annex to the work program with a description of the changes | The changes were reviewed and approved | | |
|---|---|---|---|---|
| | | Date and number of the protocol of the meeting of the department | Head of Department | Guarantor of the educational program |
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## 1. GENERAL INFORMATION ABOUT THE EDUCATIONAL COMPONENT

| | | | | | |
|---|---|---|---|---|---|
| 1. | The name is OK | Energy management and energy audit of processing and food enterprises | | | |
| 2. | Faculty/department | Engineering and technology / food technology | | | |
| 3. | The status is OK | Selective | | | |
| 4. | Program/Specialty (programs), which is a component of the OK for (to be filled in for mandatory OKs) | | | | |
| 5. | OK can be offered for (to be completed for selective OKs) | Educational program: Food technologies/specialty: 181 "Food technologies" | | | |
| 6. | NRK level | 7th level | | | |
| 7. | Semester and duration of study | Semester two<br>The duration of study is 15 weeks | | | |
| 8. | Number of ECTS credits | 5 credits | | | |
| 9. | The total number of hours and their distribution (full-time study/part-time study) | Contact work (class) | | | Independent work |
| | | Lectures<br>**14/2** | Practical/seminar | Laboratory<br>**46** | **90/148** |
| 10. | Language of education | Ukrainian | | | |
| 11. | Teacher/Coordinator of the educational component | The teacher is Ph.D., associate professor of the Department of Food Technology<br>Savchenko-Pererva Maryna Yuriivna | | | |
| 11.1 | Contact Information | Auditorium of the department 314m, building #4, phone: 0993834398, E-mail: marina.saw4encko2011@gmail.com , consultation hours: every Monday from 1 to 2 p.m. | | | |
| 12. | General description of the educational component | Familiarization with methods of assessment, analysis and planning in energy use, development of energy-saving measures at the enterprise, drawing up and development of energy-saving programs that take into account technical, economic, financial and administrative factors. Students should also familiarize themselves with the problems of choosing and justifying a more rational type of energy carriers, investing and financing in energy saving, the energy load of the enterprise, issues of information support for energy management; providing future specialists with knowledge of calculation methods and conducting energy audits of technological equipment, power supply systems, refrigeration equipment, pumping, compressor, lighting, electrothermal and other installations, and heat-using systems. | | | |
| 13. | The purpose of the educational component | Formation of the volume of theoretical and practical knowledge and skills necessary in the professional activity of future highly qualified specialists in the field of energy management, energy saving and energy audit in the food industry. | | | |
| 14. | Prerequisites for studying OK, connection with other educational components of OP | The educational component is connected with other educational components "Automation of production processes", "Processes and devices of food production", "Technological equipment of food production", "Innovative engineering" | | | |
| 15. | Policy of academic integrity | If the fact of writing off is discovered during the exam, the student's work is canceled and the exam is retaken. | | | |

## 2. CONTENT OF THE EDUCATIONAL COMPONENT (CURRICULUM PROGRAM)

**Link in Moodle: https://cdn.snau.edu.ua/moodle/course/view.php?id=2923**

| Topic.<br>List of issues to be considered within the topic | Distribution within the general time budget | | | Recommended Books[1] |
|---|---|---|---|---|
| | Auditory work | | Independent work | |
| | Lec. | Lab. | | |
| **Topic 1. Concept of energy management. Energy conservation and energy audit.**Introduction... to energy management. Concepts and objects of energy management. Basics of energy saving and energy audit. Basic concepts and terms in energy saving. Legislative basis of energy survey. The main energy problems in Ukraine. | 2 | 6 | 10 | [1-4] |
| **Topic 2.Energy management. Energy consumption accounting.**The essence, purpose, tasks, functions, principles of energy management. Matrix of energy management. Responsibilities of the energy manager. Cyclical energy management. The procedure for conducting an energy audit of the energy management system. Organization and technical means for accounting for consumed energy.<br>Energy strategy of the enterprise. Implementation of the energy management system at the enterprise. Energy strategy of the enterprise in the matter of energy efficiency. | 2 | 6 | 12 | [5-9] |
| **Topic 3. Conducting an energy audit. Assessment of energy saving potential.**Main stages of energy audit. The cost and duration of the energy audit. Energy audit report. Typical mistakes during an energy audit. Assessment of energy consumption. Cross-validation of data. Analysis of the efficiency of energy use. Environmental aspect of energy audit. | 2 | 6 | 16 | [10-14] |
| **Topic 4. The method of thermal calculation of technological heat-consuming equipment of the food industry.**Basics of energy saving in heat exchange issues. Calculation of heat balance. Determination of the heat transfer coefficient. Calculation of coolant consumption. | 2 | 8 | 14 | [15-19] |
| **Topic 5. Heat balance of a food industry enterprise.**The main components of heat balances and their definition. Analysis of heat balances. Heat balance with centralized heat supply. | 2 | 6 | 14 | [20-24] |

[1]A specific source from the main or additional recommended literature

| | | | | |
|---|---|---|---|---|
| **Topic 6. Objects of energy audit. Calculation of energy consumption for the equipment of processing enterprises.**Pasteurization and cooling installations. Sterilization and cooling installations. Equipment for the production of fermented milk products and cheeses. Vacuum evaporation units for the production of condensed milk and dairy products. Drying installations for the production of dry dairy products. Steam chambers. Autoclaves. Cauldrons for cooking meat broths. Tanks for scalding. Evaporation units. Auto smokehouses. Preparation of smoke and air-smoke mixtures. Energy audit of refrigeration equipment; heat supply systems; ventilation and air conditioning systems. | 2 | 8 | 14 | [25,26] |
| **Topic 7. Use of secondary energy resources and alternative and renewable energy sources.**Characteristics of secondary energy resources. The main directions of using secondary energy resources. Characteristics of alternative and renewable energy sources. The main directions of using alternative and renewable energy sources. | 2 | 6 | 10 | [8-10, 13, 27] |
| **In total** | **14** | **46** | **90** | |

## 4. TEACHING AND LEARNING METHODS

| **DRT** | **Teaching methods**(work to be carried out by the teacher during classroom classes, consultations) | **Number of hours** | **Teaching methods** (what types of educational activities should the student perform independently) | **Number of hours** |
|---|---|---|---|---|
| DRT 1. Know the essence of energy management, the energy strategy of enterprises in the matter of energy efficiency, implementation of the energy management system at the enterprise; matrix of energy management, management of energy use, methods of researching the efficiency of energy resource use | To analyze, using examples of scientific and technical literature, the ways of selecting the necessary information regarding innovations in energy saving | 16 | Preparation for the lecture by familiarization with the lecture material. Search for technical solutions in information sources | 26 |
| DRT 2. To know the method of thermal calculation of technological heat-consuming equipment of the food industry; methods of determining | Giving examples and techniques using an interactive method | 18 | Preparation for the lecture by familiarization with the lecture material. Studying the material for independent | 26 |

| | | | | |
|---|---|---|---|---|
| energy characteristics of equipment and technological processes; methods of calculating energy consumption for the equipment of processing enterprises. | | | mastery. Completion of tasks of practical work, the implementation of which began in the practical session. | |
| DRT 3. To know the methods of determining heat balances of a food industry enterprise; methods of calculating energy resource losses; basics of rational operation of heat and power supply systems. | Demonstration of examples of solving production problems using an interactive method in lectures and practical classes | 8 | Preparation for the lecture by familiarization with the lecture material. Studying the material for independent mastery. Completion of tasks of practical work, the implementation of which began in the practical session. | 14 |
| DRT 4. Know the types of energy audit; main stages of energy audit; methods of determining and reducing losses of various types of energy in technical and technological objects. | Demonstration of examples of work in applied software products | 10 | Preparation for the lecture by familiarization with the lecture material. Studying the material for independent mastery. Preparation of theoretical material in the form of publications. | 14 |
| DRT 5. Know ways to use secondary energy resources and alternative and renewable energy sources; energy saving methods; a general approach when conducting an energy audit. | Demonstration of examples of solving production problems using an interactive method in lectures and practical classes | 8 | Preparation for the lecture by familiarization with the lecture material. Studying the material for independent mastery. Completion of tasks of practical work, the implementation of which began in the practical session. | 10 |

## 5. EVALUATION BY THE EDUCATIONAL COMPONENT

### 5.1.Summative assessment

5.1.1. To assess the expected learning outcomes, it is provided

| No | Methods of summative assessment | Points / Weight in the overall assessment | Compilation date |
|---|---|---|---|
| 1. | Written control work on the theoretical material | *20 points / 20%* | 15 week |

| | | | |
|---|---|---|---|
| 2. | Implementation and protection of practical works | *20 points / 20%* | 15 week |
| 3. | Testing for independent work is a multiple-choice test | *15 points / 15%* | 15 week |
| 4. | Control work | *15 points / 15%* | 8 week |
| 5. | The exam is a written answer to the ticket | *30 points / 30%* | |

5.1.2. Evaluation criteria

| **Component**[2] | **Unsatisfactorily** | **Satisfactorily** | **Fine** | **Perfectly**[3] |
|---|---|---|---|---|
| *Written control work on the theoretical material* | *<12 points* | *12-15*points | *15-18 points* | *20 points* |
| | *Task requirements not met* | *Answers to all questions are given, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question* | *All questions are answered* | *Answers to all questions are given, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed* |
| *Implementation and protection of practical works* | *<12 points* | *12-15*points | *15-18 points* | *20 points* |
| | *Task requirements not met* | *Answers to all questions are given, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question* | *All questions are answered* | *Answers to all questions are given, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed* |
| *Testing on independent work* | *<9 points* | *9-11*points | *11-13 points* | *15 points* |
| | *Correct answers are less than 6 out of 10* | *6 or 7 out of 10 correct answers* | *Correct answers 8 or 9 out of 10* | *Correct answers 10 out of 10* |
| | *<9 points* | *9-11*points | *11-13 points* | *15 points* |

[2]Specify the summative assessment component

[3]Specify the distribution of points and the criteria determining the level of assessment

| | | | | |
|---|---|---|---|---|
| *Control work* | *Task requirements not met* | *Answers to all questions are given, but individual components of the answers are missing or insufficiently disclosed, there is no analysis of other approaches to the question* | *All questions are answered* | *Answers to all questions are given, creativity and thoughtfulness are demonstrated, and one's own solution to the problem is proposed* |
| *Exam* | *<18 points* | *18-23 points* | *24-29 points* | *30 points* |
| | *Task requirements not met* | *Most of the requirements are met, but individual components are missing or insufficiently disclosed, there is no analysis of other approaches to the issue* | *All requirements of the task have been fulfilled* | *All the requirements of the task have been fulfilled, the own solution and approach have been demonstrated* |

**5.8. Formative assessment:**

To assess the current progress in learning and understand the directions for further improvement is provided

| *No* | ***Elements of formative assessment*** | ***Date*** |
|---|---|---|
| *1.* | *Written survey after studying topics 1, 2-6, 7-9* | *3 week, 7 week, 14 week* |
| *2.* | *Verbal feedback from the teacher while working on a modular coursework* | *11 week* |
| *3.* | *Verbal feedback from students to the teacher after writing a modular term paper* | *14 week* |

Self-assessment can be used as an element of summative assessment and formative assessment.

## 6. EDUCATIONAL RESOURCES (LITERATURE)


1. Energy conservation and energy management: Study guide / Bakalin Yu.I. - Kharkiv: BURUN and K, 2006. - 320 p.
2. Solovei O.I. etc. Energy audit: Training manual / O.I. Solovei, V.P. Rosen, Y.H. Lega, O.O. Sytnyk, A.V. Chernyavskyi, G.V. Toad – Cherkasy: ChDTU, 2005. – 299 p.
3. V. V. Prokopenko, O. M. Zakladny, II. V. Kulbachny Energy audit with examples and illustrations: Training manual. - K.: Education of Ukraine, 2008. - 438 p.
4. Manual on the course "Fundamentals of energy management" / ESCO electronic journal of the energy service company "Ecological systems" energy management, No. 1, 2011.
5. Bulyandra O.F. Teplotechnika: / Bulyandra O.F., Draganov B.H., Fedoriv V.G. etc.-K: Vyshcha shk., 1998.-336 p.

6. Pavelko V.I. Heat supply of enterprises of the meat processing and milk processing branches of industry. Tutorial. – Vinnytsia: Nova kniga, 2007. I.S. Guliy. Equipment of processing and food industry enterprises. – Vinnytsia: New Book, 2001.
7. Panfilov V.A. Machines and apparatus of food production. M: "Vysshaya shkola", 2001
8. Law of Ukraine "On Energy Saving" dated 01.07.94 No. 74/94–BP, with amendments and additions.
9.DSTU 4065-2001. Energy saving. General technical requirements. – Effective from 01.07.02. - K.: State Standard of Ukraine.
10. DSTU 4713:2007. Energy saving. Energy audit of industrial enterprises. Procedure and requirements for the organization of work. – Valid from 01.07.07. - K.: State Standard of Ukraine.
11. Energy saving. All-Ukrainian Scientific and Technical Journal.
12. New topic. Scientific and technical journal.
13. ESTA (Energy-saving technologies and automation) Journal of Ukraine
14.Integrated technologies and energy savingJournal of Ukraine
15. Energy saving. Power engineering. Energy audit, (North-Eastern Energy Company "SVEKO" LLP)
16. Law of Ukraine "On Energy Saving" dated 01.07.94 No. 74/94–BP, with amendments and additions.
17. Andrizhnevsky A.A. Energy conservation and energy management: Textbook. manual / A.A. Andrizhnevsky, V.I. Volodyn. - 2nd ed., ed. - Mn.: Higher. Shk., 2005. – 294 p.
18. Malyarenko V.A., Nemirovsky I.A. Energy saving and energy audit. Textbook / Ed. Prof. Malyarenko V.A. - Kharkiv: Khnakh, 2008. - 253 p.
19. DSTU 4081-2002. Energy saving. Energy labeling of household electrical equipment. General technical requirements. Valid from 01.05.02. - K.: State Standard of Ukraine.
20. DSTU 2339-94. Energy saving. Substantive provisions. – Valid from 01.01.95. - K.: State Standard of Ukraine.
21. DSTU 2420-94. Energy saving. Terms and definitions. – Valid from 01.01.95. - K.: State Standard of Ukraine.
22. DSTU 2155-93. Energy saving. Methods of determining the economic efficiency of energy saving measures. – Valid from 01.01.95. - K.: State Standard of Ukraine.
23. DSTU 2804-94. Energy balance of an industrial enterprise. Terms. Terms and definitions. – Valid from 01.01.96. - K.: State Standard of Ukraine.
24. DSTU 4110-2002. Energy saving. Methodology of analysis and calculation of specific consumption of energy resources. – Effective from 01.07.03. - K.: State Standard of Ukraine.
25. DSTU 4714:2007. Fuel and energy balances of industrial enterprises. Methodology of construction and analysis. – Valid from 01.07.07. - K.: State Standard of Ukraine.
26. DSTU 4715:2007. Energy saving. Energy management systems of industrial enterprises. Composition and content of works at the stages of development and implementation. – Valid from 01.07.07. - K.: State Standard of Ukraine.
27. DSTU 4472:2005. Energy saving. Energy management systems. General requirements. – Valid from 01.07.06. - K.: State Standard of Ukraine.