Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of machines and devices of chemical and oil refining industries

FUNDAMENTALS OF APPARATUS REPAIR AND ASSEMBLY

Working program of the academic discipline (Syllabus)

Details of the academic discipline	
Level of higher education	***First (undergraduate)***
Branch of knowledge	*13 Mechanical engineering*
Specialty	*133 Industrial engineering*
Educational program	*Computer-integrated technologies of chemical engineering equipment design*
Discipline status	*Selective*
Form of education	*daytime*
Year of training, semester	*4th year, spring semester*
Scope of the discipline	*4 ECTS credits*
Semester control/ control measures	*Assessment, MKR, calculation work*
Lessons schedule	
Language of teaching	*Ukrainian*
Information about the course leader / teachers	Lecturer:*Ph.D., Serhiy Valeriyovych Gulienko,sergiiguliienko@gmail.com, +38504488173* Practical:*Ph.D., Serhiy Valeriyovych Gulienko,sergiiguliienko@gmail.com, +38504488173* Laboratory:not provided for in the curriculum
Placement of the course	

Program of educational discipline

1. Description of the educational discipline, its purpose, subject of study and learning outcomes

Modern enterprises of the chemical and related branches of industry are complexes of complex technological installations designed for the production of a large number of products for the economy. These technological installations include machines, vessels, devices, pipelines, pipeline fittings and control and measuring devices of various designs and purposes, which unite under the general term equipment. The equipment used to carry out the target technological process is called technological. The key elements of technological equipment in the chemical industry are the devices that are considered in this course. In the chemical industry, devices can work in conditions of high or low temperatures, high excess pressures and deep rarefaction, the action of aggressive environments, etc. A consequence of this design requirement, production, operation and repair of devices are increased. Therefore, when preparing bachelors for the specialty 133 Industrial mechanical engineering, the educational program Computer-integrated technologies of chemical engineering equipment design, it will be appropriate to study the educational component "Fundamentals of apparatus repair and installation"

Installation, that is, the installation of the product or its components at the place of its use, equipment at chemical and oil refining enterprises is carried out during the construction of new facilities, as well as during the reconstruction and repair of existing ones. At the same time, the following types of work are performed: rigging (loading, unloading, moving and installing equipment in the design

position); locksmith and assembly (equipment assembly); mechanical assembly (installation and adjustment of pumps, compressors, fans, etc.); welding, laying pipelines and some other works.

Maintenance and repair is a set of all technical and organizational actions, including technical supervision, aimed at maintaining or returning objects to a state in which it is able to perform the required function.

The educational component "Fundamentals of repair and installation of devices" involves the study of regulatory documentation on the installation, operation and repair of devices, as well as typical operations performed during these types of activities.

The subject of the educational component "Fundamentals of apparatus repair and installation" - Standard regulations for repair and installation of chemical industry equipment, organization and basic equipment for repair. Equipment commissioning measures.

The purpose of the educational component "Fundamentals of repair and installation of devices" is to form a set of knowledge:

- To draw up standard regulations for the repair of chemical industry equipment, reasonably organize repairs and select equipment for repair.

- Plan and organize equipment installation and commissioning.

- To substantiate the technological regulations for the repair of equipment of the chemical industry.

- Apply professional knowledge to create conceptual engineering models of systems and processes; solve engineering problems of conceptualization using innovative methods.

- Use computer-integrated technologies for modeling the operation of equipment under various conditions.

- Using regulatory and technical documentation, as well as working, operational and repair documentation, participate in the facility's testing program.

2. Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

The educational component "Fundamentals of device repair and installation" is optional.

Requirements for starting studies include knowledge, mathematics, mastering the disciplines "Machine parts", "Mechanics of materials and structures", "Calculation and design of typical equipment", "Materials science"

The study of the discipline will be useful for diploma design, as well as for mastering the material of a number of disciplines of master's training.

3. Content of the academic discipline

Chapter 1. Installation of devices

Topic 1.1. Organization of installation works

Completeness, preservation and storage of equipment of chemical and oil refining industries. General issues of installation and equipment organization. Documentation of installation works. Geodetic justification of installation.

Topic 1.2 Carrying out installation work

Preparation of equipment and foundation for installation. Installation of equipment on the foundation. Rigging works. Equipment testing and commissioning works.

Chapter 2. Operation of devices

Topic 2.1 Operation of equipment

Equipment operation. Operating documentation General information about equipment reliability.

Topic 2.2 Reliability of equipment.

Reliability indicators. Factors affecting equipment reliability. Methods of ensuring equipment reliability.

Chapter 3. Repair of devices

Topic 3.1 Maintenance

General information about maintenance and repair. Maintenance.

Topic 3.2 Repair

Organization of equipment repair. Equipment repair technology

Chapter 4. Safety techniques

Safety techniques during installation, operation and repair of equipment

4. Educational materials and resources

Basic literature:

1. *Mikulon I.O. Installation, operation and repair of equipment of chemical and oil refineries: Training. manual. - K.: IZMN, 1998. - 256 p.*
2. *Mikulonok I.O., Manufacturing, installation and operation of chemical production equipment [Text]: textbook for students. higher education closing - K.: NTUU "KPI", 2012. - 419 c.: ill. - Bibliography: p. 413–415.*
3. *Kornienko Y.M. Processes and equipment of chemical technology [Text]: tutorial. / Y.M. Kornienko, Yu.Yu. Lukach, I.O. Mikulonok et al.. - K.: NTUU "KPI", 2011. - Part 2. - 416 p.*
4. *Methodical instructions for performing practical work for students of specialty 7.05050315 "Equipment of chemical industries and building materials enterprises" from the discipline "Installation and operation of equipment of chemical industries": [Electronic resource]:/ NTUU "KPI"; structure. V.L. Dakhnenko. - Kyiv: NTUU "KPI", 2015. 22 p.*

***Additional literature**:*

1. *Couper JR, Penney WR, Fair JR, Walas SM (2012). Chemical Process Equipment. Selection and Design. Third Edition. Amsterdam. Elsevier.*
2. *Perlmutter BA (2022). Integration and Optimization of Unit Operations Review of Unit Operations from R&D to Production: Impacts of Upstream and Downstream Process Decisions. Amsterdam. Elsevier.*
3. *Nouri M., Lucke E. (2022). Life cycle of a process plant. Amsterdam. Elsevier.*
4. *Ray S., Das G. (2020). Process Equipment and Plant Design Principles and Practices. Amsterdam. Elsevier.*
5. *Soroush M., Baldea M., Edgar TF (2020). Smart Manufacturing. Applications and Case Studies. Amsterdam. Elsevier.*
6. *Lieberman N. (2019). Understanding Process Equipment for Operators and Engineers. Amsterdam. Elsevier.*

(Educational content

5. Methods of mastering an educational discipline (educational component)

Lecture classes

Lectures are aimed at:

- *provision of modern, integral, interdependent knowledge in the discipline "Fundamentals of membrane technology", the level of which is determined by the target setting for each specific topic;*
- *ensuring creative work of students together with the teacher during the lecture;*
- *education of students' professional and business qualities and development of their independent creative thinking;*
- *forming the necessary interest in students and providing direction for independent work;*
- *definition at the current level of scientific development in the field of membrane technology;*
- *reflection of the methodical processing of the material (highlighting of the main provisions, conclusions, recommendations, their wording is clear and adequate);*
- *the use of visual materials for demonstration, combining them, if possible, with the demonstration of research results;*
- *teaching research materials in a clear and high-quality language with observance of structural and logical connections, clarification of all newly introduced terms and concepts;*
- *accessibility for perception by this audience.*

No. z/p	***The name of the topic of the lecture and the list of main questions (list of didactic tools, references to the literature and tasks on the SRS)***	***Hour***
1	*Lecture 1. Completeness, conservation and storage of equipment of chemical and oil refining industries.* *Literature: [1-2]* *Assignment to SRS: Documentation attached to the equipment. Supplier guarantees*	*2*
2	*Lecture 2. General issues of installation and equipment organization. Documentation of installation works. Geodetic justification of installation. Preparation of equipment and foundation for installation.* *Literature [1-2]* *Tasks for SRS: De-preservation of equipment*	*2*
3	*Lecture 3. Installation of equipment on the foundation. Rigging works. Equipment testing and commissioning works.* *Literature [1-2]* *Tasks for SRS: Peculiarities of installation and dismantling in buildings*	*2*
4	*Lecture 4. Equipment operation. Operating documentation General information about equipment reliability. Reliability indicators* *literature* *Tasks for SRS: Technical diagnosis and control of technical condition*	*2*
5	*Lecture 5. Factors affecting equipment reliability. Methods of ensuring equipment reliability.* *Literature [1-2]* *Task for SRS: Corrosion of equipment*	*2*
6	*Lecture 6. General information about maintenance and repair. Maintenance* *Literature [1-2]*	*2*
7	*Lecture 7. Organization of equipment repair* *Literature [1-2]* *Assignment to SRS: Repair documentation*	*2*
8	*Lecture 8. Equipment repair technology* *Literature [1-2]* *Tasks for SRS: Defectometry*	*2*
9	*Lecture 9. Safety techniques during installation, operation and repair of equipment* *Literature [1-2]*	*2*
	In total	***18***

Practical training

In the system of professional training of students from this educational component, practical classes occupy 33% of the classroom load. As a supplement to the lecture course, they lay and form the foundations of the bachelor's qualification. The content of these classes and the method of conducting them should ensure the development of the creative activity of the individual. They develop technical thinking and the ability to use special terminology, allow you to test knowledge, therefore this type of work is an important means of operational feedback. Practical classes should perform not only cognitive and educational functions, but also contribute to the growth of students as creative workers.

The main tasks of the cycle of practical classes:

- *help students systematize, consolidate and deepen knowledge of a theoretical nature in the field of membrane technologies;*
- *to teachstudents in the methods of solving practical tasks, to promote the mastery of skills and abilities to perform calculations, graphic and other tasks;*
- *to teachtheir work with scientific and reference literature;*
- *to form skillsto learn independently, that is, to master the methods, methods and techniques of self-learning, self-development and self-control.*

No. z/p	***Name of the subject of the practical session and list of main questions (a list of didactic support, references to the literature and tasks on the SRS)***	***Hour***
1	*Calculation of devices for the installation of devices*	*2*
2	*Calculation of the foundation and pivot joint*	*2*
3	*Calculation of the anchor and mounting mast*	*2*
4	*Implementation of the foundation bolt plan*	
5	*Implementation of the device slinging scheme*	
6	*Issuance of the passport of the vessel*	
7	*Issuance of the passport of a vessel operating under a pressure of more than 0.6 MPa*	
8	*Modular control work. Protection of the abstract*	*2*
9	*Test*	*2*
	In total	*18*

6. Independent work of student

Independent work takes 70% of the time of studying the educational component, including preparation for the assessment, modular control work and preparation of the essay. The main task of students' independent work is to acquire knowledge from the course that was not included in the list of lecture questions by personally searching for information, forming an active interest in a creative approach to educational work. In the process of independent work within the framework of the educational component, the student must learn to analyze modern thermodynamic methods used in chemical engineering.

No. z/p	*The name of the topic submitted for independent processing*	*Number of hours of SRS*
1	*Preparation for lectures*	*18*
2	*Self-study of topics:* *Documentation attached to the equipment. Supplier guarantees* *Decommissioning of equipment* *Features of installation and dismantling in buildings* *Technical diagnostics and control of the technical condition*	*30*

	Equipment corrosion *Defectometry*	
3	*Preparation for MCP*	*14*
5	*Execution of the essay*	*16*
6	*Preparation for the test*	*6*
	Hours in general	*66*

Policy and control

7. Policy of academic discipline (educational component)

Rules of attending classes and behavior in classes

Attending classes is a mandatory component of the assessment. Students are obliged to take an active part in the educational process, not to be late for classes and not to miss them without a good reason, not to interfere with the teacher conducting classes, not to be distracted by actions unrelated to the educational process. When solving problems in practical classes, students can use any sources of information and means of calculations. All tasks are performed individually.

Rules for the protection of individual tasks

The curriculum provides for an individual lesson in calculation work. The calculation work is the calculation of the membrane device according to the standard method [2, 3] with justification of the chosen method and analysis of the calculation results

review of scientific articles (for example, from [7, 8]) on a specific topic. The abstract is defended in the form of a short (up to 3 minutes) oral report.

Rules for assigning incentive and penalty points

- *incentive points can be awarded by the teacher exclusively for the performance of creative works in the discipline or additional completion of online specialized courses with the receipt of the appropriate certificate:*

But their sum cannot exceed 25% of the rating scale.

- *Penalty points are not provided within the academic discipline.*

Policy of deadlines and rescheduling

In the event of arrears from the academic discipline or any force majeure circumstances, students should contact the teacher through available (provided by the teacher) communication channels to resolve problematic issues and agree on an algorithm of actions for practice.

Policy of academic integrity

Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the absence of references for the use of printed and electronic materials, quotes, opinions of other authors. Inadmissible tips and write-offs during writing tests, conducting classes; passing the exam for another graduate student; copying materials protected by the copyright system without the permission of the author of the work.

The policy and principles of academic integrity are defined in Chapter 3 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute". More details:https://kpi.ua/code

Policy of academic behavior and ethics

Students should be tolerant, respect the opinions of others, formulate objections in the correct form, constructively support feedback during classes.

Standards of ethical behavior of students and employees are defined in Chapter 2 of the Code of Honor of the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute". More details:https://kpi.ua/code

8. Types of control and rating system for evaluating learning outcomes (RSO)

Distribution of study time by types of classes and tasks in the discipline according to the working study plan:

Semester	Training time		Distribution of study hours				Control measures		
	Credits	Acad. hours	Lectures	Practical	Lab. do	SRS	MKR	RR.	Semester control
6	4	120	18	18	–	64	-	1	test

The student's rating in the discipline consists of the points he receives for: completing 7 tasks in practical classes, defending the essay and MKR.
Semester control is credit.

System of rating (weighted) points and evaluation criteria

The system of rating points and evaluation criteria:

Performing tasks in practical classes.

The weighted point is 10. The maximum number of points for practical classes is 7·10=70.

Execution and defense of the abstract. Weight score 20.

Modular control work. Weight score 10

Credit is issued based on the results of work in the semester.

A student who received at least 60 points in the semester can take part in credit work to get a higher point. In this case, the points obtained by him on the control work with the addition of 50% of the points obtained in the semester are final.

The credit control work (if necessary) is evaluated out of 70 points. The control task consists of two theoretical tasks.

Each task is evaluated out of 35 points according to the following criteria:

- *excellent performance of the task, fluency in defense material - 32-34 points.*
- *good level of performance, correct answers to questions when defending the task - 25-30 points.*
- *sufficient level of performance of the task, the presence of minor inaccuracies in the answers - 20-22 points.*
- *poor quality of work, ignorance of theoretical material - 0 points.*

The condition of the first attestation is obtaining at least 20 points and completing 50% of practical work (at the time of attestation). The condition for the second attestation is to obtain at least 36 points and complete 75% of practical work (at the time of attestation).

The sum of the points received by the student is transferred to the examination grade according to the table:

Scores	***Rating***
95...100	*perfectly*
85...94	*very good*

75...84	*fine*
65...74	*satisfactorily*
60...64	*enough*
RD<60	*unsatisfactorily*
Admission conditions not met	*not allowed*

Working program of the academic discipline (syllabus):

Foldedassociate professor MAHNV, Ph.D., Assoc. Serhii GULIENKO

Approvedby the MAHNV Department (protocol No. 19 dated 17.05.2023)

Agreedby the methodical committee of the faculty (protocol No. 10 dated 05/26/2023)