


**Ministry of Education and Science of Ukraine
Dnipro University of Technology**

DEPARTMENT OF "*Chemistry*"

"APPROVED"
Head of Department

 Svietkina O. Yu.
30.06.2020

WORK PROGRAM OF THE ACADEMIC DISCIPLINE

"*Chemistry*"

Field of study.....	19 Architecture and construction
Specialty.....	192 Construction and Civil Engineering
Academic degree.....	Bachelor
Academic program.....	192 Construction and Civil Engineering
Type of discipline.....	Basic
Total workload.....	3 credits (90 hours)
Type of final assessment.....	exam
Period of study.....	2,3 semesters 2;3;4 quarter (i) 2020-21
Language of study.....	English

Lecturers: prof. Svetkina O. Yu., as. Tarasova H. V

Prolonged: for 20 __ / 20__ academic year _____ (_____) " __ " __ 20__.
(Signature, name, date)

for 20 __ / 20__ academic year _____ (_____) " __ " __ 20__.
(Signature, name, date)

Dnipro
NTU "DP"
2020

Work program of the academic discipline “Higher Mathematics” for bachelor’s specialty **192 Construction and Civil Engineering** / O.Yu. Sviatkina, H.V. Tarasova / NTU “Dnipro Polytechnic” Department Of Chemistry. - DA: NTU «DP» 2020 - 13 p.

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The work program regulates:

- key goals and objectives;
- the disciplinary learning outcomes generated through the transformation of the intended learning outcomes of the degree program;
- the content of the discipline formed according to the criterion “disciplinary learning outcomes”;
- the discipline program (thematic plan by different types of classes);
- distribution of the discipline workload by different types of classes;
- an algorithm for assessing the level of achievement of disciplinary learning outcomes (scales, tools, procedures and evaluation criteria);
- criteria and procedures for evaluating the academic achievements of applicants by discipline;
- the contents of the educational and methodological support of the discipline;

The work program is designed to implement a competency approach in planning an education process, delivery of the academic discipline, preparing students for control activities, controlling the implementation of educational activities, internal and external quality assurance in higher education, accreditation of degree programs within the specialty.

Approved by the decision of the Methodical Commission of specialty **192 Construction and Civil Engineering** (protocol протокол № 7 від 26.06.2020).

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1 DISCIPLINE OBJECTIVES

In the educational and professional programs of the Dnipro University of Technology specialty 192 Construction and Civil Engineering, the distribution of program learning outcomes (NRN) for the organizational forms of the educational process is done. In particular, the following learning outcomes are attributed to the discipline F17 " **Chemistry**":

PH9	Applying the basic theories, methods and principles of natural sciences.
PH12	Use modern building materials, products and structures in the design and construction of construction projects depending on the technology of their manufacture and technical characteristics

The objective of discipline – is to develop students' logical thinking, emphasizing the importance of chemical knowledge in the creation and use of building materials, operation of machines and mechanisms, the creation of new environmentally friendly technologies, work in compliance with safety rules, formation of future professionals (specialists) ideas about the systems of operation of installations and systems.

The study of this discipline will provide a holistic view of the subject of chemistry and its role in industry; get an idea of the laws of chemistry, the structure of the atom, chemical bonds, the basic laws of chemical processes; learn to understand the nature of chemical transformations; to gain practical knowledge during the performance of laboratory works, which can be used to assess the feasibility of production, fuel and energy systems of the country.

Achieving the goal requires the transformation of program learning outcomes into disciplinary and the choice of the content of the discipline according to this criterion

2 INTENDED DISCIPLINARY LEARNING OUTCOMES

Code NRN	Disciplinary learning outcomes (DRN)	
	DRN code	content
PH9	PH9-1	Know the basic chemical laws and be able to classify the basic properties of materials by their structure. Be able to determine the molar mass of substance equivalents
PH9	PH9-2	Know the patterns of chemical processes and be able to influence them
PH9	PH9-3	Know and classify dispersed systems. Be able to calculate the concentrations of substances
PH9	PH9-4	Know the basics of electrolytic dissociation and be able to determine the hydrogen index of solutions
PH9	PH9-5	Know the mechanism of redox reactions.
PH12	PH12-1	Use the properties of metals to obtain energy, be able to calculate the electromotive force

Code NRN	Disciplinary learning outcomes (DRN)	
	DRN code	content
PH12	PH12-2	Know the basics of electrochemistry and be able to conduct electrolysis of solutions and melts
PH12	PH12-3	Use knowledge of the mechanism of corrosion in the selection and construction of construction projects

3 BASIC DISCIPLINES

Subjects	The acquired learning outcomes
Chemistry of the general secondary school	Classes of inorganic and organic compounds
	Basic knowledge of the structure of atom, nomenclature
	Know the basic chemical properties of elements and compounds is

4 WORKLOAD DISTRIBUTION BY THE FORM OF EDUCATIONAL PROCESS ORGANIZATION AND TYPES OF CLASSES

Type of classes	Workload hours	Distribution by forms of education, hours					
		Full-time		Part-time		Distance	
		Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)	Classes (C)	Individual work (IW)
lecture	45	16	29	29	-	4	36
laboratory	45	16	29	-	-	8	37
tests	-	0	0	0	-	5	-
TOGETHER	90	32	58	29	-	17	73

Note: The ratio of the number of hours of classroom classes to independent and individual work for full-time study is – 0.55

5 DISCIPLINE PROGRAM BY TYPES OF CLASSES

DRN code	Types and topics of training sessions	Workload hours
	LECTURES	45
PH9-1	Basic concepts and laws of chemistry. Structure of atoms and chemical bond.	4
PH9-2	Regularities of chemical processes. Chemical kinetics. Chemical equilibrium	4
PH9-3	Disperse systems. Solutions	6
PH9-4	Theory of electrolytic dissociation. Ionic product of water. Hydrogen value. Solid hydrolysis.	6
PH9-5	Redox processes.	6
PH12-1	Galvanic cells. Electrolysis. Batteries.	4
PH12-2	Corrosion of metals and measures to protect against corrosion.	8
PH12-3	General ideas about inorganic binders. Physico-chemical properties of inorganic binders Introduction to organic chemistry	7

	LABORATORY WORK	45
PH9-1	LW-1 – Instruction on safety rules in the chemical laboratory. Determination of molar mass of metal equivalent;	6
PH9-2	LW 2 – Chemical kinetics;	4
PH9-3	LW-3– concentration;	4
PH9-4	LW 4 – Ionic reaction;	6
PH9-5	LW 5 – Solid Hydrolysis;	6
PH12-1	LW 6 - Redox;	4
PH12-2	LW 7 - Galvanic processes (problem solving);	8
PH12-3	LW 8 - Electrolysis as an electrochemical factor of action;	3
	LW 8 - Different variants of electrolysis processes. Problem solving;	2
	LW 10 - Corrosion of metals and protection against it.	2
TOGETHER		90

6 TASKS FOR SELF TRAINING

The main tasks for self training are:

- 1) preliminary processing of information concerning the module (topic);
- 2) preparation for the current tests - solving tasks of self-control on each topic;
- 3) performance of an individual task;
- 4) preparation for the defense of an individual task;
- 5) preparation for the final test.

7 KNOWLEDGE PROGRESS TESTING

Certification of student achievement is accomplished through transparent procedures based on objective criteria in accordance with the University Regulations “On Evaluation of Higher Education Applicants' Learning Outcomes”.

The level of competencies achieved in relation to the expectations, identified during the control activities, reflects the real result of the student's study of the discipline.

7.1 GRADING SCALES

Assessment of academic achievement of students of the Dnipro University of Technology is carried out based on a rating (100-point) and institutional grading scales. The latter is necessary (in the official absence of a national scale) to convert (transfer) grades for mobile students.

The scales of assessment of learning outcomes of the NTUDP students

Rating	Institutional
90 ... 100	Excellent
74 ... 89	Good
60 ... 73	Satisfactory
0 ... 59	Failed

Discipline credits are scored if the student has a final grade of at least 60 points. A lower grade is considered to be an academic debt that is subject to liquidation in accordance with the Regulations on the Organization of the Educational Process of NTUDP.

7.2 DIAGNOSTIC TOOLS AND EVALUATION PROCEDURES

The content of diagnostic tools is aimed at controlling the level of knowledge, skills, communication, autonomy, and responsibility of the student according to the requirements of the National Qualifications Framework (NQF) up to the 7th qualification level during the demonstration of the learning outcomes regulated by the work program.

During the control activities, the student should perform tasks focused solely on the demonstration of disciplinary learning outcomes (Section 2).

Diagnostic tools provided to students at the control activities in the form of tasks for the intermediate and final knowledge progress testing are formed by specifying the initial data and a way of demonstrating disciplinary learning outcomes.

Diagnostic tools (control tasks) for the intermediate and final knowledge progress testing are approved by the appropriate department.

Type of diagnostic tools and procedures for evaluating the intermediate and final knowledge progress testing are given below.

Diagnostic and assessment procedures

INTERMEDIATE CONTROL			FINAL ASSESSMENT	
training sessions	diagnostic tools	procedures	diagnostic tools	procedures
lectures	control tasks for each topic	task during lectures	comprehensive reference work (CCW)	determining the average results of intermediate controls; CCW performance during the examination at the request of the student
practical	control tasks for each topic	tasks during practical classes		
	or individual task	tasks during independent work		

During the intermediate control, the lectures are evaluated by determining the quality of the performance of the control specific tasks. Practical classes are assessed by the quality of the control or individual task.

If the content of a particular type of teaching activity is subordinated to several descriptors, then the integral value of the assessment may be determined by the weighting coefficients set by the lecturer.

Provided that the level of results of the intermediate controls of all types of training at least 60 points, the final control can be carried out without the student's

immediate participation by determining the weighted average value of the obtained grades.

Regardless of the results of the intermediate control, every student during the final knowledge progress testing has the right to perform the CDF, which contains tasks covering key disciplinary learning outcomes.

The number of specific tasks of the CDF should be consistent with the allotted time for completion. The number of CDF options should ensure that the task is individualized.

The value of the mark for the implementation of the CDF is determined by the average evaluation of the components (specific tasks) and is final.

The integral value of the CDF performance assessment can be determined by taking into account the weighting factors established by the department for each NLC descriptor.

7.3 EVALUATION CRITERIA

The actual student learning outcomes are identified and measured against what is expected during the control activities using criteria that describe the student's actions to demonstrate the achievement of the learning outcomes.

To evaluate the performance of the control tasks during the intermediate control of lectures and practicals the assimilation factor is used as a criterion, which automatically adapts the indicator to the rating scale:

$$O_i = 100 a / m,$$

where a - number of correct answers or significant operations performed according to the solution standard; m - the total number of questions or substantial operations of the standard.

Individual tasks and complex control works are expertly evaluated using criteria that characterize the ratio of competency requirements and evaluation indicators to a rating scale.

The content of the criteria is based on the competencies identified by the NLC for the Bachelor's level of higher education (given below).

Integral competence is the ability to solve complex problems and specialized practical problems in a particular area of professional activities or in a learning process that involves the use of certain theories and methods of the relevant scientific areas and characterized by complexity and conditions uncertainty.

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
Knowledge		
♦ Conceptual knowledge acquired during the training and	- A great - proper, reasonable, sensible. Measures the presence of: - conceptual knowledge; - a high degree of state ownership issues; - critical understanding of the main	95-100

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
professional activities, including some knowledge of modern achievements; ♦ critical understanding of the main theories, principles, methods, and concepts in education and careers	theories, principles, methods and concepts in education and careers	
	A non-gross contains mistakes or errors	90-94
	The answer is correct but has some inaccuracies	85-89
	A correct some inaccuracies but has also proved insufficient	80-84
	The answer is correct but has some inaccuracies, not reasonable and meaningful	74-79
	A fragmentary	70-73
	A student shows a fuzzy idea of the object of study	65-69
	Knowledge minimally satisfactory	60-64
	Knowledge unsatisfactory	<60
Ability		
♦ solving complex problems and unforeseen problems in specialized areas of professional and/or training, which involves the collection and interpretation of information (data), choice of methods and tools, the use of innovative approaches	- The answer describes the ability to: - identify the problem; - formulate hypotheses; - solve problems; - choose adequate methods and tools; - collect and interpret logical and understandable information; - use innovative approaches to solving the problem	95-100
	The answer describes the ability to apply knowledge in practice with no blunders	90-94
	The answer describes the ability to apply knowledge in practice but has some errors in the implementation of a requirement	85-89
	The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the two requirements	80-84
	The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the three requirements	74-79
	The answer describes the ability to apply knowledge in practice but has some errors in the implementation of the four requirements	70-73
	The answer describes the ability to apply knowledge in practice while performing tasks on the model	65-69
	A characterizes the ability to apply knowledge in performing tasks on the model, but with uncertainties	60-64
	The level of skills is poor	<60
Communication		
♦ report to specialists and non-specialists of information, ideas, problems, solutions and their experience in the field of professional activity; ♦ the ability to form an effective	- Fluent problematic area. Clarity response (report). Language - correct; - - net; - - clear; - - accurate; - - logic; - - expressive; - - concise. Communication strategy:	95-100

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
communication strategy	coherent and consistent development of thought; availability of own logical reasoning; relevant arguments and its compliance with the provisions defended; the correct structure of the response (report); correct answers to questions; appropriate equipment to answer questions; the ability to draw conclusions and formulate proposals	
	Adequate ownership industry issues with minor faults. Sufficient clarity response (report) with minor faults. Appropriate communication strategy with minor faults	90-94
	Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (total three requirements are not implemented)	85-89
	Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (a total of four requirements is not implemented)	80-84
	Good knowledge of the problems of the industry. Good clarity response (report) and relevant communication strategy (total not implemented the five requirements)	74-79
	Satisfactory ownership issues of the industry. Satisfactory clarity response (report) and relevant communication strategy (a total of seven requirements not implemented)	70-73
	Partial ownership issues of the industry. Satisfactory clarity response (report) and communication strategy of faults (total not implemented nine requirements)	65-69
	The fragmented ownership issues of the industry. Satisfactory clarity response (report) and communication strategy of faults (total not implemented 10 requirements)	60-64
	The level of poor communication	<60
Autonomy and responsibility		
<ul style="list-style-type: none"> ♦ management actions or complex projects, responsible for decision-making in unpredictable conditions; ♦ responsible for the professional development of individuals and/or groups ♦ the ability to continue study with a high degree of autonomy 	<ul style="list-style-type: none"> - Excellent individual ownership management competencies focused on: <ol style="list-style-type: none"> 1) management of complex projects, providing: <ul style="list-style-type: none"> - exploratory learning activities marked the ability to independently evaluate various life situations, events, facts, detect and defend a personal position; - the ability to work in a team; - control of their own actions; 2) responsibility for decision-making in unpredictable conditions, including: <ul style="list-style-type: none"> - justify their decisions the provisions of the regulatory framework of sectoral and national levels; - independence while performing tasks; - lead in discussing problems; - responsibility for the relationship; 3) responsible for the professional development of individuals and/or groups that includes: <ul style="list-style-type: none"> - use of vocational-oriented skills; - the use of evidence from independent and correct 	95-100

descriptors NLC	Requirements for knowledge, communication, autonomy and responsibility	Indicator evaluation
	reasoning; - possession of all kinds of learning activities; 4) the ability to further study with a high degree of autonomy, which provides: - degree possession of fundamental knowledge; - independent evaluation judgments; - high level of formation of general educational skills; - search and analysis of information resources	
	Confident personality possession competency management (not implemented two requirements)	90-94
	Good knowledge management competencies personality (not implemented three requirements)	85-89
	Good knowledge management competencies personality (not implemented the four requirements)	80-84
	Good knowledge management competencies personality (not implemented six requirements)	74-79
	Satisfactory ownership of individual competence management (not implemented seven requirements)	70-73
	Satisfactory ownership of individual competence management (not implemented eight claims)	65-69
	The level of autonomy and responsibility fragmented	60-64
	The level of autonomy and responsibility poor	<60

8. Information resources

1) O.Y Svietskina Methodical instructions and tasks for self-work on the discipline of chemistry for students of all specialties (part 1) / O.Y Svietskina O.B. Netyaga, G.V. Tarasova Ministry of eduk. and sien of Ukrain, Nation. min. univer. – D .:, NMU, 2018. –21 p.

2) O.Y Svietskina Methodical instructions and tasks for self-work on the discipline of chemistry for students of all specialties (part 2) / O.Y Svietskina O.B. Netyaga, G.V. Tarasova Ministry of eduk. and sien of Ukrain, Nation. min. univer. – D .:, NMU, 2018. –17 p.

3) O.Y Svietskina Methodical instructions "Laboratory work on chemistry" on the discipline of chemistry for students of all specialties/ O.Y Svietskina O.B. Netyaga, G.V. Tarasova Ministry of eduk. and sien of Ukrain, Nation. min. univer. – D .:, NMU, 2016. –20 p.

4) Svietskina O. Y. Basic concepts and laws of chemistry. Guidelines and objectives for self-study courses for students in all specialties / O. Y. Svietskina, O.B. Netyaga, G.V. Tarasova; Ministry of eduk. and sien. of Ukraine, Nation. min. univer. – D .: NMU, 2016. –20 p.

5) Chang R. GENERAL CHEMISTRY. The Essential Concepts./ /FIFTH EDITION: Published by McGraw-Hill, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020. Copyright © 2008 by The McGraw-Hill Companies, Inc.– 836 p. ISBN 978–0–07–304851–2 MHID 0–07–304851–8 ISBN 978–0–07–304857–4 (Annotated Instructor’s Edition) MHID 0–07–304857–7

<https://www.rachidscience.com/2020/08/book-general-chemistry-5th-edition-by.html>

Internet resource:

<http://chemistry-chemists.com>

<http://himik.nmu.org.ua/ua/>

<http://fit.nmu.org.ua/ua/>

<http://trrkk.nmu.org.ua/ua/>

Educational edition

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192 Construction and Civil Engineering

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Prepared for publication

Dnipro University of Technology.

Certificate of registration in the State Register, control number 1842

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